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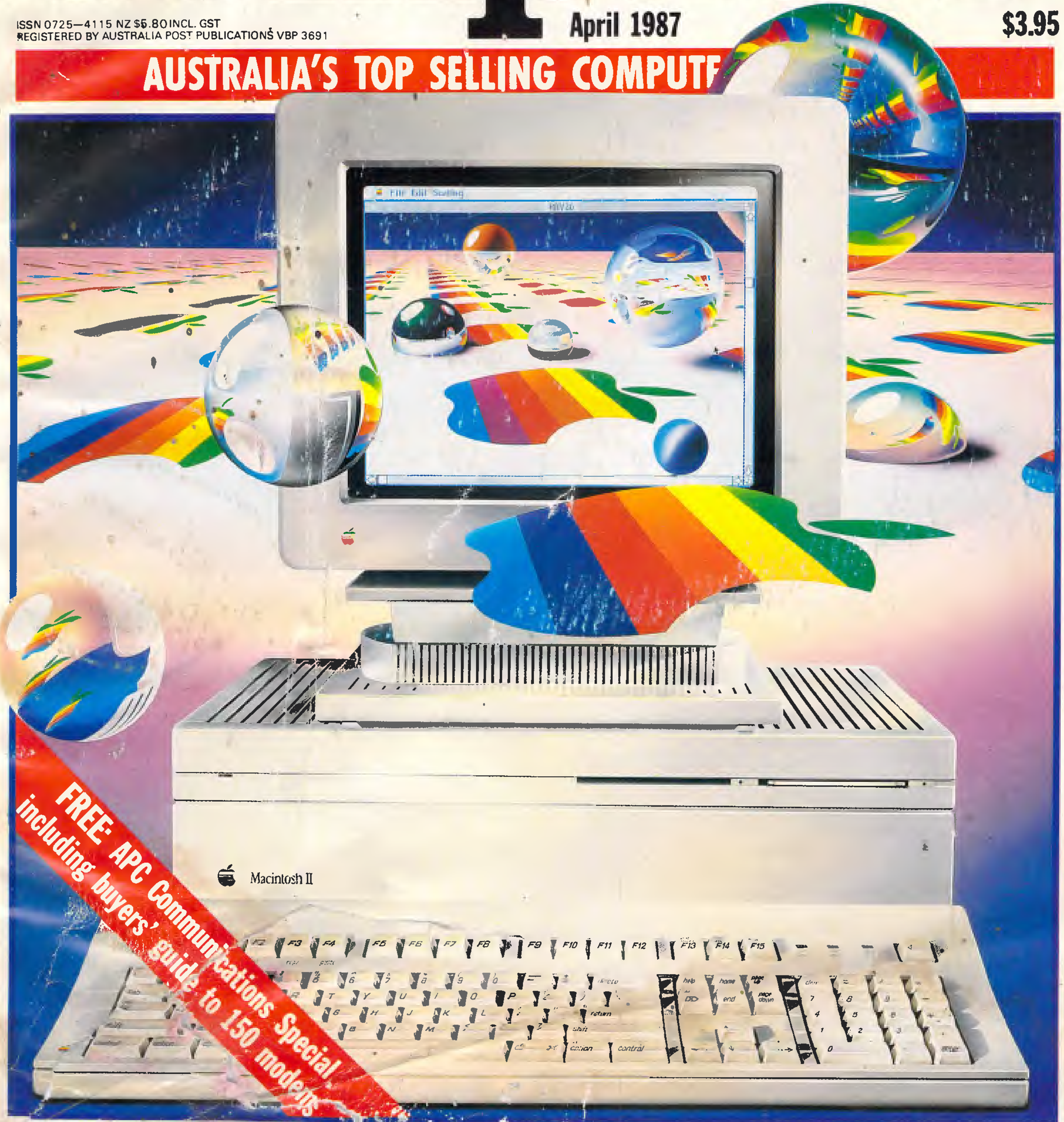
Amiga 2000 exclusive review

AUSTRALIA'S TOP SELLING COMPUTE



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THE COLOURFUL WORLD OF THE MAC II

Full Benchtest: Apple's new 'Open-Macs'

Which of these new words will give you the most zitboodle?

Remember the good old Anglo-Saxon days when *wig* meant *war*?

How about when *radio* was *wireless*?

Every year, new words creep into our language, giving us greater control of our ever-changing world.

In this list of recent arrivals you will find one new Word in particular that gives you power over all others.

anfo *[milit]* a type of home-made explosive used for terrorist bombs in Ulster.

bumblepuppy *[sport]* in bridge, a game played at random, with neither rhyme, reason nor sensible planning.

cocktail *[medic]* **1.** a barium enema. **2.** castor oil.

electronic smog *[audio]* non-ionising radiation – i.e.: radio or TV waves or radar – emitted into the air in such amounts as to threaten public health.

FIDO *[aerospace]* Fog Investigation Dispersal Operation: a method of dispersing fog above airports by using the heat from petrol burners.

fuff [TV] fake snow for wintertime effects.

googol *[science]* slang for 10 to the hundredth power.

humint *[espionage]* human intelligence: gathering of material by means of human beings – spies – rather than by electronic surveillance.

kludge *[computers]* **1.** an improvised do-it-yourself lash-up which may well work. **2.** a factory-made computer which still has some (endearingly) odd characteristics.

meg *[finance]* $1,000,000.

nodders [TV] the interviewer's reaction shots, often no more than nodding at the answers his questions receive, which are usually filmed after the actual interview and edited into the tape prior to transmission.

nuplex *[industry]* a complex of manufacturers all of whom use nuclear power within their factories or plants.

nybble *[computers]* half a byte or four bits.

operant conditioning *[business]* the persuading of one's workforce to do what you wish them to do – often by providing incentive schemes, productivity bonuses, etc.

psychic income *[econ]* **1.** aka: *psychic compensation*: the non-monetary and non-material satisfactions that ideally accompany an economic or work activity. **2.** the non-measurable mental and emotional satisfaction a consumer gleans from an item or a service that he/she purchases.

quasimodo *[sport]* in surfing, riding a surfboard in a crouched position; from the posture of the fictional 'Hunchback of Notre Dame' in Victor Hugo's *Notre Dame de Paris* (1831).

rep-tile *[maths]* aka: *reptile*: two-dimensional figures of which two or more can be grouped together to make larger scale models of themselves.

soup *[science]* the waste products of a chemical process.

space gun *[aerospace]* a hand-held instrument that propels the astronaut while he is working outside the capsule.

S O F T

vidkids *[entertain]* youthful addicts of computerised arcade video games.

wargasm *n [milit]* a crisis that could lead to the outbreak of a war; the war that followed such a crisis: in both cases the image is of an escalating compulsion towards conflict that takes over from sense and restraint and must reach its nuclear climax.

white hole *[science]* a hypothetical source of matter or energy, posited as the 'other ends' of black holes and as such expelling all the matter and energy.

wormhole *[science]* a hypothetical passageway in space that connects a black hole and a white hole.

yumpsville *n [movies]* the unsophisticated rural and small-town audience whose favourite films mix sex and violence and keep the dialogue and intellectual stimulus down to a minimum.

zitboodle *[business]* power. (see *New Microsoft Word*).

New Microsoft Word 3.0 *[for the Macintosh]* is the last word in document processing.

You could say it's the new Word for Power: It is already acclaimed as *the most powerful* word processing program on *any* personal computer.

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Of course within the friendly graphic environment of your Macintosh, new Microsoft Word is an eminently simple program to fully exploit and explore.

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* Definitions from *Newspeak. A dictionary of jargon* by Jonathon Green. (Except for *zitboodle*. We invented one great new Word so why not another?)

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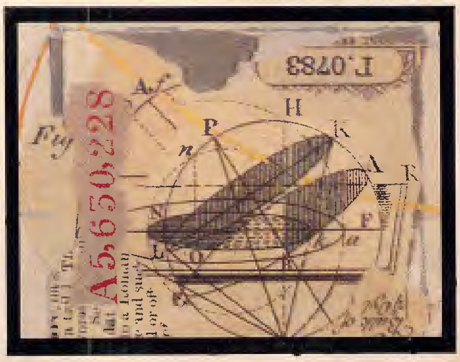
Volume 8, Number 4, April 1987

REGULARS



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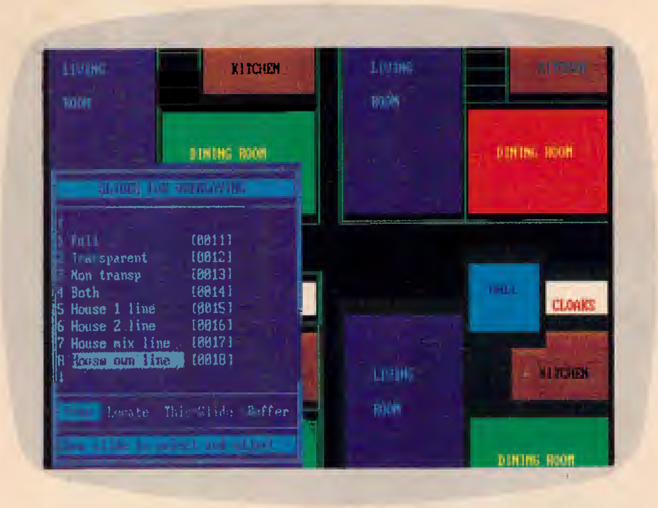

FEATURES


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EGA PAINT

Guy Kewney reports that Clive Sinclair is at it again: this time with an ultra cheap, ultra portable micro. Also there's a round-up on Sydney's Australian Personal Computer Show staged last month and a promising looking word processor from Borland.

Introducing the perfect word processor

This Newsprint comes to you courtesy of Word Perfect, a word processor. The reason for using it isn't that it's new — it isn't (well, this is a new version, but that's all) — but because I have discovered that it is the ancestor of Sprint, Philippe Kahn's new word processor.

Just to whet your appetite for the next few paragraphs: I saw Kahn open a file and type (rapidly) a couple of paragraphs into the middle of it. He then, almost instantly, pulled the plug out.

On restarting the computer, all his new text was there.

Kahn is boss of Borland, the company which has given us SideKick, Turbo Pascal, Turbo Pascal toolkits and, most recently, Turbo Prolog.

Sprint, the $US199 word processor which Kahn will deliver around August, together with Sidekick II and Eureka (a problem solver) and Turbo C and Turbo Basic (language compilers) are still under development or at beta-test sites. Only a fool can pretend to be surprised when software is delivered late, and this will be delivered later than expected.

When Sprint comes, however, it will be worth the wait. About the only thing it can't do is create 'outlines' for planning purposes.

Kahn gave us a demonstration of the code in its beta-test form. It wasn't a pre-set demo: he put a projection screen up in a hotel room and did what people told him to do.

The program is, already, the fastest piece of word processing technology I've ever seen.

On an ordinary Compaq, not a 286 version, it took perhaps just over one second to move the cursor from the top to the bottom of a document. Nothing fancy about that, you say; how long was the document? It was 500k long, that's how long.

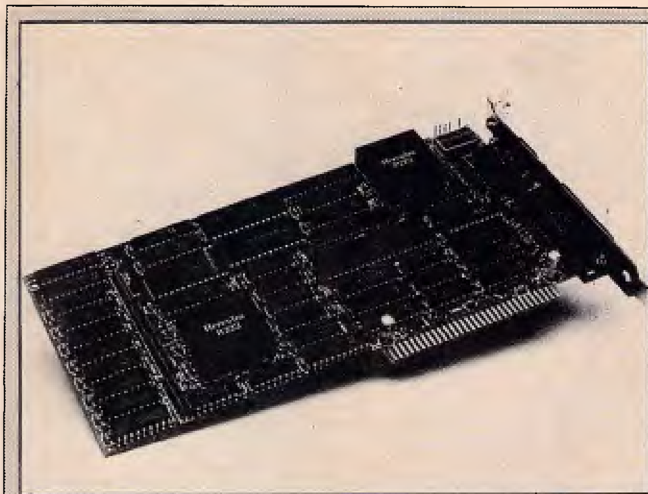
Finding a unique word in the middle of it took perhaps three seconds, maybe less.

For the life of me I can't think of any feature I asked for, except vertical windows (it does horizontal windows) which it doesn't have.

It will work with script columns (scripts are typed with stage directions on the left, script on the right) and newspaper columns. It can do fancy scripts, foreign language characters, and even the menus can be in any language you like. If you don't like the phrase 'advanced' for one of the menus, change it. When that menu comes up, you will no longer have to type 'A' for 'Advanced', however, but 'P' for 'Perfect' or whatever.

Ah, says the sceptic — I don't want to learn a new word processor. I've become so good at WordStar/Multimate/SamnaWord/ whatever, that I couldn't possibly adjust to a new one.

Borland has the answer: Sprint will emulate other word processors. It comes pre-supplied with most best-selling word processor commands, and others can be



No-one knows exactly what graphics standard will evolve over the next year, but with a fair chance that IBM is planning to 'move the goal-posts' on compatibility, one company at least is doing pretty well — NEC.

The NEC Multisync monitor will automatically operate at the standard scan rate needed for IBM colour graphics. It will switch, when software asks it to, to the higher scan rate required by enhanced graphics (EGA) and it will also run at an even higher scan rate which, a lot of people think, might be needed for the next generation of PC-compatibles.

One alternative, however, is the Incolor card from Hercules. Hercules is the company which pioneered the idea of doing text and graphics together on the same screen — real, bit-mapped graphics; and proper, character-generated text.

The company has now extended this concept past the point of simple mixed displays. The Incolor card, due to be released for about $US400 in the States in April/May, does in hardware what you would otherwise need a program like Fontasy to handle.

Admittedly, Fontasy costs less but it doesn't really create letters onscreen. However pretty, the font generated by Fontasy are graphics characters.

From the Incolor card, however, you get an extra 3000-odd characters to play with. They are generated continuously onscreen by a character generator: you can move them, edit them, insert new characters, delete old ones, and change their colours. And because the card does it all in text mode — graphics and all — screen-handling is extremely fast.

The card was due to arrive on my desk somewhere between the time you read this and the time I wrote it.

Unanswered, at the time of writing, were questions like: will it work with Gem? Will desktop publishing packages like Ventura be able to use its amazingly small detail? How do you transfer its colours to colour printers?

Guy Kewney

written — even by yourself, if you fancy tackling the job in the Sprint control language.

Kahn introduced his presentation by explaining that the product was about to go to beta-test and he didn't think he could keep it secret. So he'd decided to make it an official announcement.

Unfortunately, as with all exciting products, getting an early view of Sprint has just increased my thirst. And the earlier the view, the longer I'll have to put up with other word processors with half the features.

Guy Kewney

The soft advantage

What do traditional lapheld machines (Tandy 102, NEC, Olivetti M10) have over Sinclair's new beast *(see story elsewhere on this page — Ed)*?

Answer: software. Sardine, for example, just released by Traveling Software in the States, is a chip which plugs into those machines. It crams in a spelling checker, a word processor, and (if you have a diskette drive) a 33,000-word dictionary to check documents against.

Cost is a pitifully low $US170. You do have to have Traveling Software's Ultimate ROM II, to make full use of it, but it will function with other word processors.

Traveling Software also has a disk operating system (launched late 1986) for 3.5in diskettes. This costs $US90 on disk and $US119 on ROM; the obvious advantage of the ROM is that you don't have to enter the boot code first.

Details in the US on (206) 483 8088.

Window on desktop publishing

It is commonly believed, in Silicon Valley, that IBM nearly offered to buy Digital Research, author and publisher of Concurrent DOS 386.

This operating system, just announced, is giving DR yet another chance to try and steal Microsoft's throne in the kingdom of the IBM user.

Digital Research has a new boss, now that John Rowley has been moved out. He is ex-IBM executive Dick Williams, working as the enterprise manager in partnership with Gary Kildall, founder, who will play the role of technical guru.

I asked Williams point blank whether IBM tried to buy the company, and he said, equally point blank, that it didn't.

He had a very, very senior position in the more mainframe side of IBM, based in San Jose, a couple of dozen miles away from Monterey. And he says if there had been a takeover of that sort, he damn well would have known.

'I think, partly, people heard that I was asking to meet Gary, looking for a job,' said Williams, 'and it was reported out of context.'

As to whether the company really has a chance of making the big time with Concurrent DOS 386, I'm not volunteering an opinion.

But one of the most difficult parts of multi-tasking software is the time taken to test it fully, and DR has

Clive Sinclair is riding high again. And if his new computer works the way he plans it to work, then he's back in business. Once again, he's doing it on his own. Starting last month, Sinclair's new company, Cambridge Computer, ran mail-order adverts in UK micro magazines offering the Z88, a lapheld product to be available in May. Sinclair expects a waiting list, despite the delay.

The price of two hundred pounds (about $470) and the weight of less than a kilogram make this 'super-portable' 8-bit business system a breakthrough in lapheld computing. The closest on both points is the Tandy 102, which is twice the weight and almost twice the price at $799.

Sinclair's machine has far more versatile software, with an integrated spreadsheet, editor, diary and calculator which makes it a widely useful design. It also includes BBC Basic. And it has vastly more memory capacity. With a theoretical maximum size of 4Mbytes of memory, it's expandable — in one way at least — as far as people are likely to expect during its lifetime.

Assuming the machine makes it to Australia and at not too great a price hike and if it works, I'd buy a Z88. It really is important, if you are carrying a machine around, that it is light. I use a Tandy 102 not because it has the functions I need, but because it's the only machine which doesn't break my back at exhibitions. But even that is more weight than I'm confortable with.

The Z88's screen map is a great solution to the problem of the limited display. My own preferred solution would be to have a socket from which a full-screen composite video output could be taken. Sinclair says this isn't possible.

The spreadsheet is good enough to be used in board meetings by people who want to do more complex calculations than could be done on paper with a calculator. Sinclair himself thinks it is all the spreadsheet that anyone will ever need, and while it's true that most people barely use five per cent of their spreadsheet power, I think he's being over-optimistic.

The text editor is fascinating and I think I'd be able to use it — for note-taking. I'd like a parallel port, but I'll settle for a link to the next PC as a pretty good option.

My overall impression? If it works, it could be something new in a market that hasn't been properly exploited.

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been developing Concurrent for so long that there really must be a chance it has it right at last.

Microsoft has described its latest DOS, which is a less ambitious affair but with windowing built in, as 'as ready as any operating software is in its first release.' If there's much multi-tasking in that, then DR may just be able to do something because Microsoft is not notorious for over-fast delivery of operating software.

There is another point which is going to sound perverse when I make it, I know. That is, that Microsoft is sounding very, very positive about Windows. So damn positive, in fact, that I smell a rat.

Sources on America's West Coast tell me definitely that IBM is *not* going to choose Windows as the front end for its 80386 machine.

The people at Microsoft I talk to, smile when I say that.

'Don't print that unless you want to look silly,' they say. They also say that desktop publishing is the big breakthrough for Windows in its fight against Gem, and I have a feeling that the cards are falling the other way.

Certainly, it isn't true that Venture, the Gem-based desktop publishing package, is 'just about to appear under Windows.'

What Xerox has said, under pressure, is that it does intend to produce a Windows version of Ventura. It hasn't said when.

Well, we'll see, won't we?

Guy Kewney

The Portable III, previously rumoured to be an 80386-based portable, turned out to be Compaq's smallest, lightest and fastest to-date but was not the lapheld many expected. The Portable III uses an 80286 at 12MHz, in line with the current trend for high-speed PC/XT compatibles. The machine looks a bit like a small sewing machine or a large toaster when packed up. The full-size keyboard unclips from the front to reveal a neat plasma display. This lifts up and swivels so that it can be placed in a good position for reading — very weird-looking but practical.

The standard model of the Portable III, the Model 20 comes with 640k of RAM, a high-performance 20Mbyte hard disk, a 1.2Mbyte 5 1/4in floppy, and serial, parallel and RGB interfaces. This model weighs a perfectly reasonable 9kg and will cost $9671.

Two other models are available with slight variations. All machines can be expanded by adding a plug-on expansion unit with two slots for plug-in cards. The expansion box makes the whole machine look rather like it is carrying some sort of Compaq ultra-compact in a babysling.

Compaq admits that the new machine is aimed at restoring its 'sanctified' Number One spot in the portable market, which has recently been under pressure from several other manufacturers — notably Toshiba with the T1100 Plus and T3100, and Zenith with the recently introduced Z181.

Compaq is on (02) 660 0077.

A future for the Transputer

Ignore all these IBM groupies who keep telling you about the Intel 80386 and the future of computing. Go and look at the Transputer.

Ever seen a Mandelbrot diagram? Inmos was drawing them in colour, in incredible detail, in real time, a whole screen in less than a second. To do this, Inmos put together a system with faulty chips.

The Transputer can handle data going to and from other transputers, memory, and the rest of the world. These chips couldn't handle memory, except what they included in their own circuitry.

By putting six rows of seven chips on a board, and six boards in a crate, Inmos has produced a system with 252 Transputer chips. It would cost a lot to build out of fully functioning chips, but so what? — the point is made.

Now there is a new Transputer: the T800.

Software engineer Tim King of Perihelion Software has been playing with one. He's an expert on the Motorola 68000 family, having written AmigaDOS for the Commodore machine.

His assessment of the machine: after running a Benchmark on the Motorola 68020 with a maths co-processor (the 6818, I think) at 25MHz, it achieved a remarkable speed. It was able to process a Whetstone floating point test a million times a second.

A single T800, however, was able to do four mega-Whetstones, all on its own.

Don't be fooled by the fact that there are no Transputer-based machines in the shops: there are almost no 80386 machines in the shops either, despite the massive publicity generated about the chip.

Just remember that the Transputer, on its own, can eat the 68020 and the 80386 for lunch. And that's where one 80386 won't do, you can't just plug another in parallel, as you can with the Transputer.

Guy Kewney

PC87

Life in the personal computer industry is now back to normal after the hectic Eighth *Australian Personal Computer* Show which closed its doors on March 20. Garry Ross filed this report on what promised to be the most exciting computer show in years:

'Computer shows are a curious phenomenon. They're a sort of mating ritual between buyer and seller — except that unlike a normal showroom, there's a whole collection of buyers and sellers all in the one big hall.

One would think therefore that the sellers would be wearing their slinkiest and most seductive garb. It is surprising, however that few do. Most exhibitors put on the fancy dress, then forget the make-up. Few exhibitors at this year's PC87 show did anything particularly special to draw attention to the new and unusual products being displayed at the show.

The best stands were those of Commodore and Atari, which is probably no surprise since both companies have felt the touch of the (in)famous Jack Tramiel.

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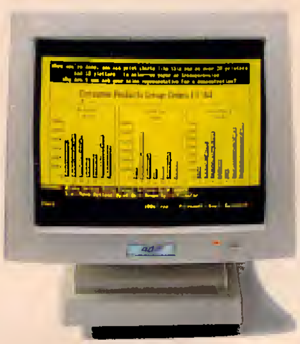

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Commodore's stand was an extravagant affair situated near the front door of the hall. You didn't even have to go into the show to be able to have a look at this one.

Tee-shirt clad lovelies handed out Commodore specification sheets at the top of the escalator, and when you approached the stand, the first thing you saw was an Amiga 2000 displaying some of the Amiga's software against a backdrop which comprised a live video picture of people approaching the stand. This is an extraordinary feat which was enough to send one maker of video films scurrying down to the Centrepoint Tower to see for himself.

Inside the stand were examples of all the new Commodore machines including the Amiga 2000 with its Motorola MC68000 processor, two disk drives and its seven expansion slots, four of which are IBM-compatible. Also on show was the new low-end Amiga, the 500, which, with its high resolution graphics, four sound channels and low price tag of $999, has the potential to become the darling of the home computer set.

Also on display was the new PC5 IBM-compatible which will retail for $1499 and the PC40, an IBM PC/AT-compatible with the standard 80286 running at 10MHz and aimed at the corporate sector.

The Mobex/Atari stand was also spectacular with all machines displayed to their best advantage. Unfortunately, the new, low price IBM-compatible did not arrive in time for the show, but the new, low-price 130XE did. This bottom-of-the-line home computer should arouse considerable interest in parents with a limited budget.

Other exhibitors did not do such a good job of showing off their wares. Take Apple for example, it had two potential show stealers: the new Mac II and the Mac SE.

Readers of last month's issue will be aware of the exciting new developments on the Apple front — the increased ROM capacity which has markedly improved overall machine performance, the new external, IBM-compatible 5¼in disk drives, and the provision, for the first time, of colour — on the Mac II.

The Mac II should have been on a spotlit plinth with coloured lights and at least a constantly running demonstration of the machine's new and enhanced capabilities. Instead the two Mac IIs that I could find were hidden away among a sea of Mac SEs. What's more, it wasn't Apple that was showing the machine, but some of its dealers. In line with its usual practice, Apple had taken out a large space in the hall and then made room available to its retailers, a few of which had Mac IIs to display. One retailer however, did Apple a service in displaying a Mac II colour card driving a 19in Moniterm screen. The pictures looked a bit washed out, lacking the vibrant colours of some IBM-compatible systems but that may just have been the screen.

On the other hand, the colour graphics on the new Apple IIGS were exemplary, being both crisp and clear. This is a machine that impressed me. The new, more powerful processor on the machine has given it the much needed punch and power. For the rest, if you knew what to look for, there were heaps of interesting things to see.

If the frequency with which items turned up on various stands is anything to go by, then the two stars of this year's show would have to be the 19in, high resolution Moniterm monitors and the Xerox Ventura desktop publishing system.

Ventura seemed to turn up everywhere, while the giant Moniterm screens were to be seen running Ventura,

Autocad and plugged into the backs of several Macintosh SEs. The Moniterm, which Megavision calls the Viking, is the only screen that can display two A4-sized pages side by side, a feat which impressed all who saw it.

Also popular were the new Wyse PC286 and the Wyse 700 screen with its 1288 x 800 resolution. Though not as popular as the 19in Moniterm monitor with its 1280 x 960 resolution, the $2400 price tag of the Wyse screen, which includes its special graphics card, will win it a lot of friends compared with the Moniterm unit which costs $6000.

The NEC Multi-synch monitors which can handle everything from IBM CGA to PGA and every graphics mode in between, made its show debut and proved very popular, partly because of the convenience it offered. No need to worry about the graphics card in the PC — just plug in the NEC and power up.

Kaypro had its new 80386 IBM-compatible prominently displayed, and was one of the few exhibitors which left machines open for all to gaze at the innards and admire the clean design.

Pacific Data did a good job of showing off its line of Thompson monitors, as was sub-distributor Imagineering. But Imagineering did not do such a good job with the AST publishing system or the new Lotus products. At no time did I see Lotus HAL, the artificial intelligence interface for 1-2-3, being put through its paces, though the box was visible on shelves. Nor did Lotus Manuscript, with its new word processor for technical writers. I did get a brief preview however, of Freelance, the new Lotus graphics program; and first impressions are good. Also impressive was the Matrix PCR camera system which can take a screen graphic and turn it into a colour slide with a resolution of 4000 lines. Now that's true high resolution graphics.

Tandy, now known as Intertan, was showing off the new Tandy 3000 HL, a 80286 powered IBM-compatible which incorporates the Chips and Technologies seven-chip AT set.

Also on show was the new Tandy 1000 EX which places the motherboard inside the keyboard. With 256k of memory and an internal single 5¼in drive the 1000 EX will retail for $1499. The screen is extra.

The machine that really caught my eye however was the new 128 Colour Computer 3. Expandable to 512k of memory, the machine is now available with Version 2 of the OS-9 operating system, which makes it the cheapest multi-user, multi-tasking, multi-window system on the market. Prices start at $449.95 and the system is expandable with external floppies and hard disks up to 50Mbytes in size.

Lap portables are still making waves. The new Wang portable made a surprise appearance at the Word Express stand. This machine has a dual Bios, allowing it to run both IBM and Wang software. Though the machine is a bit bulky, it has a good display and an internal 10Mbytes hard disk. There is no floppy — an external floppy is available as an optional extra.

Even nicer however, is the new NEC Multispeed lap portable. This has an excellent LCD screen and keyboard layout, all in a compact package with two one third size 3.5in disk drives. And wonder of wonders, it even has a built-

Continued on page 189

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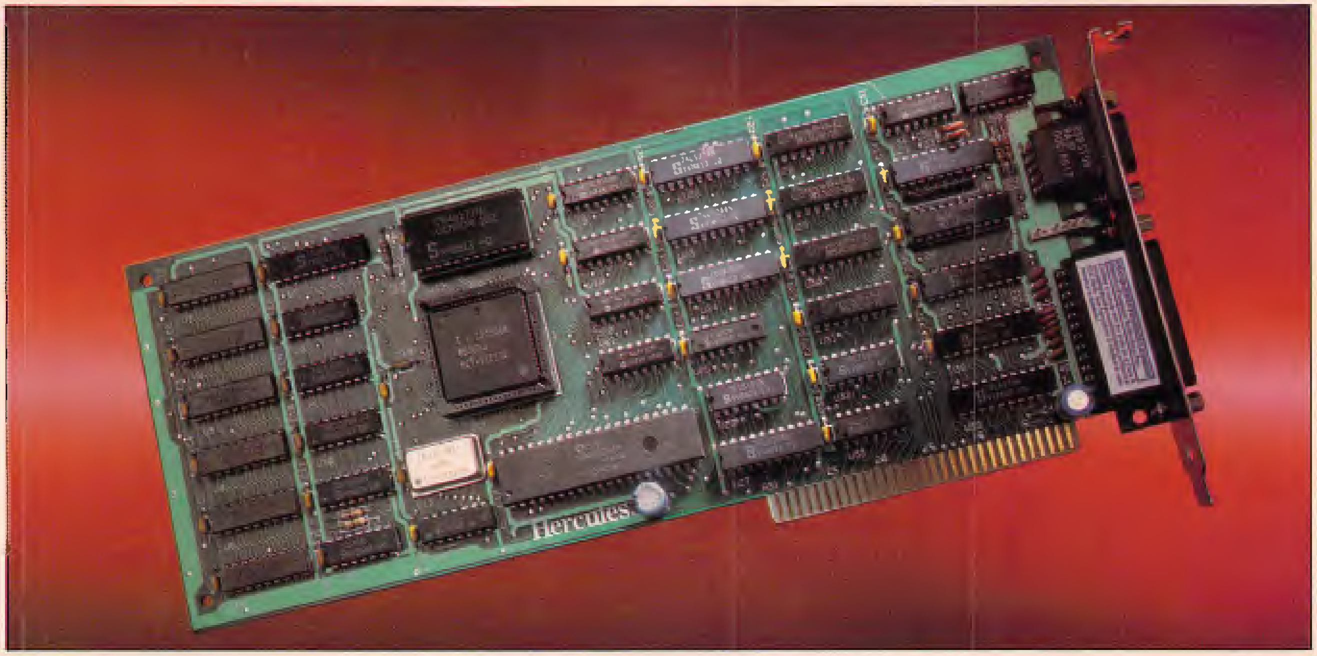

Introducing
The Hercules Graphics Card Plus

It's 100% compatible with our original card and costs 40% less. And that's not even the reason to buy one.

The reason is RamFont, an entirely new mode of operation that is unique to the Graphics Card Plus.

The idea for RamFont first occurred to Hercules co-founder and chief engineer Van Suwannukul, two years ago.

At the time he was working with Microsoft engineers on their new word processor, later known as Microsoft Word.

Microsoft's engineers knew that soon there would be very high resolution laser printers offering multiple typefaces.

VAN SUWANUKUL AND KEVIN JENKINS, CO-FOUNDERS HERCULES

They reasoned that if you could print italics and boldface, you should be able to see italics and boldface on the display.

Unfortunately, the Microsoft engineers were ahead of their time.

It was not possible, with the graphics cards that existed at the time, to get both the flexibility to display multiple typefaces, and the speed that is essential to a word processor.

Van knew that to solve Microsoft's problem, new hardware would be needed.

So he invented RamFont.

Word 3 – Three times faster.

Two years later, the Hercules Graphics Card Plus was ready.

What Van had developed was RamFont, an new mode that could store, and then display at lightning speed, 3072 programmable characters.

By this time, Microsoft's engineers had used every trick in the book to speed up Word, and succeeded in making Word 3 considerably faster than earlier versions.

However, for many users it still wasn't fast enough.

So you can imagine how delighted Microsoft's engineers were when they saw Word 3 running over three times faster on the Hercules Graphics Card Plus.

At last their word processor could really process.

1-2-3 Release 2 fulfills its promise

At Hercules, we knew that this was just the tip of the iceberg. RamFont was a revolution waiting to happen.

The more we used it, the more possibilities opened up.

Take 1-2-3 Release 2 for example.

Release 2 has an optional character set that nearly doubles the size of the viewable spreadsheet.

It's a great idea... until you try scrolling up and down or right and left. It takes forever.

As RamFont has the ability to display characters ranging in size from 8 by 4 to 9 by 16, it was easy to adapt Release 2's smaller characters.

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*Artist's impression — not technically accurate.

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As the US market becomes saturated with PC clones, the scramble to attract customers gets frenzied, but the search goes on to find the smallest computer. All the latest trans-Pacific news and gossip from our West Coast correspondent Tim Bajarin.

Tough battle ahead for PC clones

During 1986, prices of personal computers plummeted: PC configurations that sold for over $US3000 less than two years ago are now selling for under $US1000.

The American market is going through some very interesting changes at a time when clone manufacturers from Taiwan and Korea have decided to make their move on this lucrative market. At the last count, there were over 100 PC manufacturers with products in the US, all vying for the same 'customer'. But, the major change in the market direction is being brought on by first-time users who are just now thinking of buying a personal computer.

The majority of buyers at the end of 1986 were already familiar with the PC due to its use in their own offices; these people are known as Fortune 3000 workers. But, this is a relatively small market compared to the one for those who have never used a computer and could conceivably want one in the very near future.

The problem is that DOS-based PCs are very difficult to use. Try explaining the 'A prompt: b drive command' to potential buyers and they think you are speaking Swahili.

If DOS-based PCs are going to flourish for first-time users, they *must* become easier to use. As a result, vendors such as Hyundai's Blue Chip Electronics and Amstrad with its model 1512 are going to find the market very difficult to penetrate without a gimmick or two up their sleeves. Both of these vendors are using Digital Research's GEM as a screen manager in an attempt to make their machines more Mac-like and easier to use. But, it is clear from the reaction they are getting from the new user market that it is going to take much more than this for them to be successful.

Hyundai's Blue Chip is fighting to secure its place

As a result, stores have been very slow to pick up the Blue Chip PC or the Amstrad, so both companies are being forced to look to mass merchandisers for distribution — and even these stores are sceptical of these IBM 'knock-offs'.

To say that these manufacturers have been successful so far would be exaggerating. Hyundai to date has had its machines in Target Stores and Federated electronic outlets. Amstrad has gone to a distributor in Arizona who has had only mild interest in its machines. Sources close to both Target and Federated say that even though the machines are priced around $US699, the price is still too high for mass marketers to carry.

As a result, Hyundai specifically has not sold well in these stores and is beginning to seek out computer speciality stores to be its 'resellers'. Amstrad will be forced to go this route as well, but as you can imagine, speciality stores already have dozens of PCs to choose from and both Blue Chip and Amstrad will have to give cut-throat pricing to be accepted.

Muddying up these waters is Atari. Jack Tramiel and his cohorts have introduced a $US499 PC clone that, if Atari can deliver, could really shake up the low end of the market and cause a ripple effect in every channel of distribution.

Since many industry observers feel that PC clones will have to be at the $US499 level by next Christmas if they are going to sell to new users, it looks like 1987 will be a difficult year for anyone trying to make any money in the low end of the IBM PC clone market.

The incredible shrinking micro

Some of you may remember a movie a few years back called *The Incredible Shrinking Woman* Starring Lily Tomlin. Its premise was based on a person who, through mysterious circumstances, became only 9ins tall, yet was just as

much a complete person as anyone else, only smaller. The world of high technology has taken a cue from this story-line and continues to set out to 'shrink' the circuitry of a PC by taking the multitude of processors that are in the PCs of today, and putting them on, perhaps, only two small chips.

Companies like Chips and Technology and Faraday Electronics, both from Silicon Valley, are doing what in many ways is just as mysterious as the events that caused Lily Tomlin to become a shrinking dynamo.

Both firms have taken these chips and, through the magic of computer-aided design, have developed actual silicon chips that become portable brains behind what will be the computers of tomorrow.

The cumbersome computers that sit on our desks today will be replaced by slim, sexy, smaller versions; yet they will have the same power or even more.

Faraday's newest design is known as the $US25 DOS engine. This 'PC brain' is now on only two chips, instead of as many as 35, and will help to cut the cost of PCs dramatically. Chips and Technology have taken the EGA chips (normally 14) and cut the process down to only two chips as well.

Toy companies use interactive concept for products

In the CS Lewis novel *The Lion, the Witch and the Wardrobe,* children stumble into a world of fantasy by going into a closet and walking through its walls. Once they have passed through to this new world, they encounter all sorts of animals, forests and evil villains.

Another children's book, *The Tower of Geburah* by John White, takes this theme into the world of high technology by having the children literally pass through the television tube into their own world of make-believe.

Now, in 1987, toy manufacturers are giving us their own variation on this theme with a new concept called 'interactive' toys. Companies such as former toymaker Mattel, and the new kid on the block, Axlon (brainchild of Atari's original founder Nolan Bushnell) will soon be marketing ray guns, x-wing fighters and all sorts of toys that interact with specialised TV cartoon shows.

When kids shoot their power jets at the TV cartoon, the toy will record a hit. What's more, the villain on the screen can hit back and zap your pilot right out of his seat.The toy business is a multi-billion dollar industry that operates on the basis that children get tired of their old toys quickly and continually demand new ones. With this in mind, toy manufacturers are constantly looking for gimmicks to grab children's attention.

This new 'gimmick' is made possible through the world of high technology and microprocessors.

The way these things work is to incorporate high-frequency sounds, low-frequency sounds, and in some cases a type of light. These trigger the mechanisms in the gun or fighter, which in turn makes either a simple crackling noise, or perhaps even causes your pilot to eject out of his cockpit.

No matter what technology is used, you can bet that this new fad will be the hottest thing since Cabbage Patch Dolls, and millions will be spent on getting Junior the newest thing in high-tech gadgets.

An application for all tastes

To the person not familiar with what computers can do, they are often considered mechanical wonders for the folks that call themselves 'techies'. Yet, if you take the time to browse through a computer magazine, or stroll through a computer store, you may be amazed at some of the things you can do with a computer. In response to a question I often hear 'What can I do with a computer?', let me give you some ideas from software I have run across lately.

For the home and family interests, there is software written by Geneaology Software that lets you trace your family roots. You can track your baby's development, thanks to a program from Early Development Software. Want to improve relationships with your children? Try Mind over Minors from Human Edge Software. Want to design your own home? Get Architectural Design, Interior Design and Landscape Design from Hayden Software. Comedian Steven Wright says that he knows exactly when he is going to die because his 'birth certificate has an expiration date on it'. But, if your birth certificate does *not* have any of these tidings written on it and you would like to know how long you will live, try the 64 PAK program from Practicorp.

Flat too small to have pets of any kind? Get Fishies, a program that puts an animated fish tank on your screen, from Jersey Cow Software.

Low cost method of storing and transferring data

Living in the valley of the shadow of the chip, I get a chance to peek into the future when visiting 'garages' of would-be entrepreneurs. One of the more interesting products I have had a chance to see involves a video recorder. This machine has been modified to take blips and bleeps from a PC, store it on a standard 1/2in tape, then send it over television signals to another video recorder. Using this method, a 350-page book can be sent from VCR to VCR in about five seconds. As you can imagine, this raises some interesting possibilities, as well as some difficult technical problems.

Since the air waves are public and anyone with the right equipment can also tap into such data transfer, an encryption-decryption scheme is mandatory. Such a scheme would have to have its own built-in error correction device so that it would guarantee that the data sent from one source to another would be perfect: even a small loss of data could drive the end user up the wall trying to figure out what it all means. Add to that the FCC's control of these air waves, and you see that these garage 'techies' have their work cut out for them if this product is ever to reach the market.

But Hewlett-Packard and Jobs and Wozniak of Apple fame were told they were crazy when products developed in their garage were shown to others. Lucky for us, and them, that they were not deterred by the sceptics.

Why has the NEC APCIV Advanced Technology computer outsold all our competitors in the last 5 months?

Because it's got a lot more going for it:

More power. And around 40% more speed than IBM's competing computer, the IBM PC/AT.

More warranty. 12 months as against 3 months offered by most competitors.

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NEC APC IV

TULDIN

Big Blue Disk launches innovative magazine

Almost since the invention of the printing press, we have had magazines that were designed for our personal interests, and they have come in all shapes and colours. We have, for example, *Readers Digest, People Magazine, Car and Driver*. Most of these magazines flourish and and have one thing in common: they are all printed on paper. That is, until now. With the introduction of the personal computer, magazine delivery has taken a new turn. If the folks at Big Blue Disk have their way, the next major way to have a magazine delivered will be on disk.

Big Blue's magazine on a disk is a $US9.95, two-disk package that is literally a magazine. But it is not like any ordinary magazine. It has news and commentary like *Time* and it also has features giving insights, advice and reviews like any ordinary computer magazine. But this is where the similarities end. Big Blue Disk goes on to offer you real-time games, utilities, educational programs and even an actual word processor.

For $US9.95, it is one of the best bargains in the computer world and is an idea that I hope really catches on. This inexpensive family computer magazine uses Big Blue Disk's unique interactive operating system and can be bought in the US in most computer stores.

Available for the IBM PC and compatibles and the Apple II, the company can be reached at: Big Blue Disk, PO Box 30008, Shreveport, Louisiana, 71130-0008.

If your interest is education, how about Micro Speed Read. This program from CBS software teaches you to read 1000 words a minute. You can even learn how to mix drinks with a software program called Mr Boston Official Micro Bartender's Guide from concept Development Associates.

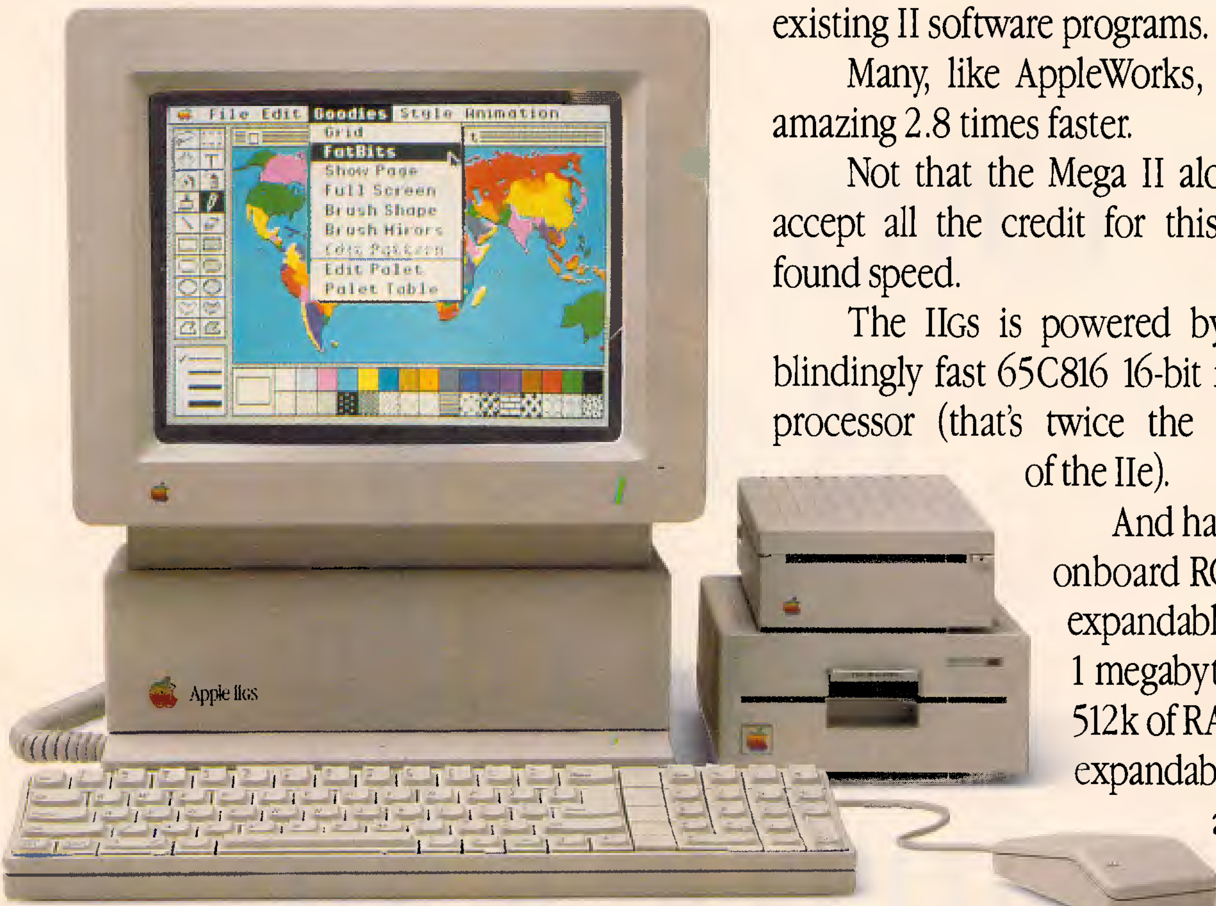
Want to know if you have ESP? Find out with Jack Houck's Psychic!

As is obvious from this short list of application programs, if there is a need or interest in your life, you can be sure that there is a computer program out there that can fill it.

END

Over the page is a new computer. Inside it are two more.

The new Apple IIGS.



The new Apple IIGS features among other things, a built-in Apple IIe and IIc.

Both of these computers, or rather, their functions, have been built into the Mega II chip you see here (and that's its actual size, of course).

Two years in the making, you'll find the revolutionary Apple Mega II microchip alongside many other new custom chips on the IIGS motherboard.

We put it there for one simple reason.

Compatibility.

The IIGS runs virtually all of the 10,000 existing II software programs.

Many, like AppleWorks, run an amazing 2.8 times faster.

Not that the Mega II alone can accept all the credit for this new-found speed.

The IIGS is powered by a new, blindingly fast 65C816 16-bit microprocessor (that's twice the power of the IIe).

And has 128k of onboard ROM that's expandable to 1 megabyte. Plus 512k of RAM, expandable to a massive 8 megabytes.

Which means you can run the most advanced software without running out of memory.

The IIGS was partly named after its graphics, and no wonder.

The IIGS can create graphics as clear and sharp as the photographs you see in this magazine.

But with one major difference.

The range of colours.

The IIGS has 4,096 in all. From delicate violet to electric red.

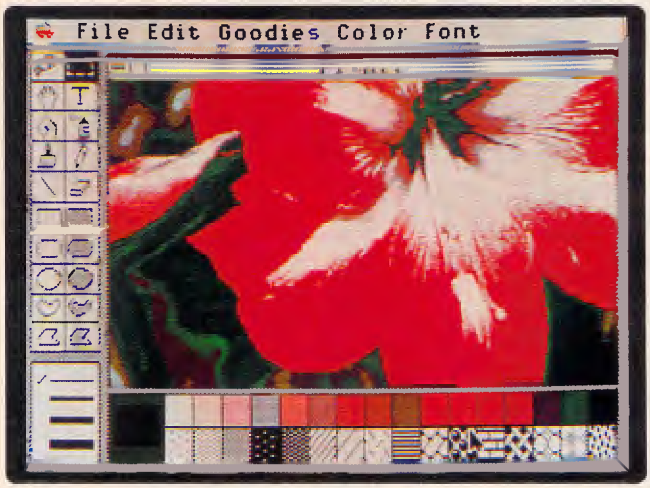
Any 256 can be used at a time in either of two graphic modes: 640 × 200 dots or 320 × 200 dots.

AP320/Palace 2

But you haven't heard anything yet. And we mean that literally.

The IIGS is so human, it even speaks.

The secret is a 32 channel Ensoniq sound chip, the kind you find in $40,000



sound synthesizers (who says Apples aren't value for money?).

It allows you to compose for and play up to 15 instruments at a time.

(Now you know where the other half of its name comes from.)

Naturally, with such high-fidelity sound, it makes sense to add the optional Bose RoomMate hi-fi speakers.

It also made sense to redesign the IIe keyboard to give you maximum freedom.

This one is detached, so you can move it all over your desk.

Or hold it in your lap.

And to make number crunching easier, there's a numeric keypad built in.

The Mouse, now standard, can be attached to either side of the keyboard.

(We didn't want to make left-handers feel left out.)

Also standard on the IIGS is MouseDesk. The software program that gives the IIGS its Macintosh-like interface.

So now, transferring ideas into action is as easy as clicking a button.

And while the IIGS is easy to use, it's just as easy to expand.

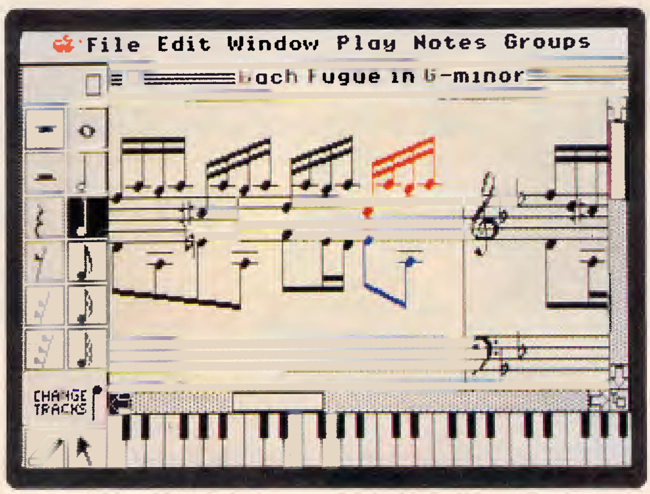
There are eight expansion ports at the back of the machine where you can plug in peripherals.

Anything from disk drives to modems, joysticks to printers.

You can share a LaserWriter with up to 30 other computers, thanks to AppleTalk, built into every IIGS.

Not only can you plug in a cord, you can plug in a card.

Take off the top of the IIGS and you'll find eight expansion slots where once again



it's easy to make the IIGS smarter, faster or more powerful.

As improvements become available, you'll also be able to plug them in. So your IIGS will never become obsolete.

The new Apple IIGS.

It's even greater than the two computers inside it.

Apple

AP320/Palace 3

NEC Powermate

NEC, a company giving IBM a run for its money in the AT market, has released its latest machine, the Powermate — an AT in an XT box. Naturally we asked Phil Cohen to check it out.

The Powermate keyboard follows the new IBM 'standard'

NEC describes the Powermate (its full title is the 'NEC APC IV Powermate 1'!) as 'an AT in an XT box'. Basically, that's just what it is — a nice, neat AT compatible in a small box. Nothing fancy, just a good machine with a smaller footprint. It also claims that it will 'have an enormous impact on the way the market perceives personal computers'. I think that unlikely.

There are a couple of things about the Powermate — apart from its size — that make it just a little different from the other AT clones. First of all, it has the new IBM XT-style keyboard, of which more later. Second, it has a space on the front panel for a 31/2in drive, either streaming tape or floppy.

Adding a 31/2in floppy drive to the Powermate makes good sense, because it means that you can swap files between it and an NEC Multispeed portable. Having a 31/2in drive on any desktop machine is a good idea in fact because the smaller 720k drives are sure to slowly replace the 51/4in drives we're all familiar with now, just as the 51/4in drives replaced the older 8in ones.

Hardware

The base configuration for the Powermate (model P- MATE-1C) consists of the motherboard box running an 8MHz 80286, fitted with two 1.2Mbyte 5 1/4in floppies, a CGA card, 640k of RAM and a colour monitor.

The box itself is surprisingly small for an AT — only 42cm wide by 43cm deep by 17cm high — and leaves lots of desk room. The front panel is plain; only the floppy disk drive lever(s) and the power and hard disk access lights are visible.

Although there is no lock on the front of the case (almost the only way to tell an AT from an XT from the outside), there is hidden under the front lip of the box a little switch which can be accessed only with the aid of a suitable sharp instrument, such as an inquisitive pencil. When the switch is on, the keyboard locks, preventing demos, long calculations, and so on from being interrupted by the merely curious. I don't know whether this useful little device will be included on all Powermates — it could be that the machine I had was a special dealer's demo model — but it's a nice touch.

(I suggest that if the keyboard lock button is going to be standard, that some mention of it is made in the documentation — otherwise someone is going to mistake it for a reset button, and wonder why their keyboard has locked permanently!)

Apart from that, there's not much to see around the front of the box. There are basically three cutouts, one of which is taken up with the 1.2Mbyte 5 1/4in floppy. The one below the floppy is either for another 51/4in floppy, or a 20Mbytes hard disk.

The price list and brochure claim that the only hard disk option is 20Mbytes; somehow the review machine had a 30Mbytes hard disk. Which means that either NEC sent a non-standard machine for review, or that it will be fitting 30Mbytes drives to all of the machines it sells. These days, there doesn't seem to be much difference between 20Mbytes and 30Mbytes in any case — 'files expand to fill the available disk space' is a useful maxim.

The third cutout is to the right of the

other two, and it's for a 720k 3½in floppy drive, or a 3½in streaming tape backup. Either would be a useful addition.

Now for the keyboard. In the past, I and most other reviewers have bemoaned the fact that IBM personal computers (with the possible exception of exotica such as the 3270 PC) have execrable keyboard layouts.

No doubt somewhere in the bowels of Big Blue, this (and of course the thought that bad keyboard design might affect sales) must have caused vague stirrings of unease. The first sign of this was the AT keyboard, which had a number of small steps for mankind (big steps for IBM keyboard layout) incorporated into it. The AT keyboard was far from perfect.

However, I am glad to say that the new IBM keyboard is pretty much what everyone has been calling for all along. IBM (which has been making typewriters with quite acceptable keyboards for longer than anyone can remember) has finally got its personal computer keyboard design together; and therefore so has NEC.

The Powermate keyboard follows the new IBM 'standard'. First, the function keys have been moved up to the top row of the keyboard, grouped into fours (there are now 12 of them) and sit above a blank space which is obviously designed to take a label to tell the user what they do under a particular application.

At the top left of the keyboard is the escape key, which after years of being used for all manner of other things, is slowly coming to mean what it used to mean back in the old mainframe days — 'get me out of here!'. The fact that most software now uses the F1 key for 'help' (IBM having eschewed the simple step of putting an actual 'help' key on its keyboard), means that the help and escape keys are both side by side where a naive user can find them — an excellent idea.

The rest of the top row is taken up with obscurities like Print Screen (no longer PrtSc, as on the PC keyboard), Scroll Lock, and Pause. The mysterious SysRq key is on the top row too — one of these days we'll find out what it's for.

The main Qwerty part of the keyboard is of course the same, except that the 'slosh' (®) key is now more accessible, at the right-hand end of the keyboard.

Finally (and as a writer of user manuals, this is what I like best about the keyboard), each of the keys has at least something written on it in English. No longer will I have to tell users to 'push the key with the arrows on it that point both left and right'. Now I can simply refer to the tab key as the Tab key. What a good idea.

This is especially good news for users who have always been confused by the difference between the cursor left key and the backspace key, both of which are marked with a left-arrow on the PC keyboard (albeit with an even more confusing number '4' on the cursor control key).

There are now actually two Ctrl and two Alt keys, just like real shift keys — one at either end of the keyboard for touch typists. And there are three LEDs at the top right of the keyboard to show when caps lock, numeric lock and scroll lock are on. I would have preferred a good old fashioned locking switch for caps lock, which means that you don't actually have to look at the keyboard to find out whether it's on or not. But I suppose I'll have to wait another few years for that innovation.

'Although putting an AT into an XT box was sure to involve compromises, NEC has not made the mistake of skimping too much on slots.'

The numeric pad is just about the same as on a PC keyboard, and the same daft arrangement of having the numeric pad double as a cursor control pad has been retained. However down at the bottom row of the keyboard there's a little group of four cursor control keys arranged in an upside-down 'T'.

This is actually some sort of European standard, I believe, for the way cursor control keys should be laid out.

Above the cursor control T is a group of keys reminiscent of the Wang WP keyboard (widely considered to be a good one), which bring the page control keys (Page Up, Page Down, Home, End) and the Delete and Insert keys together where you can find them.

So much for the keyboard layout. Under the keyboard, which has a nice long lead, is a channel to take the end of the lead. Depending on whether you are right or left-handed, you can clip the lead into this channel and make it appear from either the right or left of the keyboard, keeping it away from the mouse which lives on your desk on one side or the other.

The Powermate keyboard also has two pop-up feet, like all keyboards, although to this day I have not met anyone who folds them in.

Back at the main unit, is the standard power switch in the standard position — at the back right hand of the box. The back of the box has a power in socket and a switched power out socket, which is obviously designed to be used with the colour monitor that comes with the unit (which doesn't have an easily accessible power switch).

Power for the Powermate can be either Australian or US standard, and disappears inside the box into a sealed power supply unit. Also on the back of the case is a fan, Centronics printer and (9-pin) RS232C serial ports and of course the keyboard input socket.

The Powermate has a total of six slots: one of them an 8-bit slot and the rest 16-bit. In the standard model, one of the 16-bit slots will be taken up with the display card. If you have a hard disk model, another one of the 16-bit slots will be taken up. Even with a display card, hard disk card and, say, a memory card added, you will still have enough slots to keep going. Although putting an AT into an XT box was sure to involve compromises, NEC has not made the mistake of skimping too much on slots.

Inside, the Powermate is nice and neat. The power supply, and space for all three disk drives takes up the whole of one side of the case. The motherboard extends over about three quarters of the width of the inside of the box, and a vertical board is plugged into it and bolted onto the disk drive's outer chassis.

Presumably, this extra card is the part of the motherboard that wouldn't fit onto the motherboard. Putting extra sockets into a design always means reducing its reliability.

However, all in all it looks like a good implementation of an AT. There's a socket for an 80287 maths coprocessor, and some DIP switches that let you disable the back panel ports if you decide to replace them with ports on multi-function boards.

One surprise inside the machine was the sight of the 80286 in a locking socket — is NEC thinking of field replacement, or just worried it might fall out?

The monitor supplied with the review machine is the same as the one being supplied with the standard NEC APC IV. To my mind, it is one of the best colour monitors on the market, with a nice solid display, a tilt and swivel

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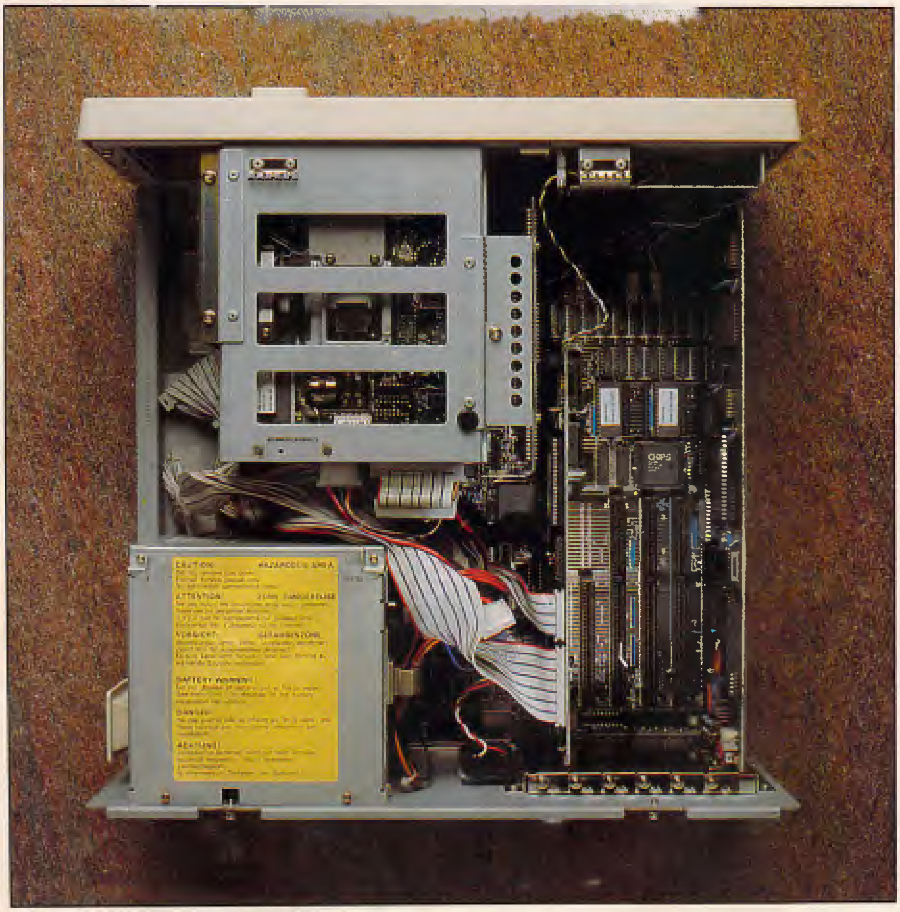
The Powermate has six slots: one 8-bit and five 16-bit



Inside , the Powermate is nice and neat

stand, and more controls than you could poke a pixel at.

Systems software

The Powermate was supplied with DOS 3.2, which is the first time I have come across anything higher than 3.1. It looks to me as if the only major difference between the two is that 3.2 has a decent manual, which is something 3.1 lacked sorely.

There are also a couple of minor enhancements, such as a better file comparison utility, which tells you how two files differ from each other (which is useful if you lose track of what you are doing while word processing).

While I was running the Powermate, a strange thing happened: the hard disk died. I suspect that a temperature sensor either in the drive or the power supply decided to shut down for a while, and the hard disk powered down. I turned the machine off for ten minutes and tried again — this time, no problems. When these mysterious faults occur, it's usually on review machines (Murphy's Law), and I'm pretty sure that if it were a common problem NEC will have licked it before it sells too many Powermates.

Applications software

The Powermate's hard disk contained a copy of a demo for 'Concorde', a package for writing demos. No doubt it was intended to show off the colour monitor and graphics capabilities of both the package and the Powermate, and it did.

Also on the hard disk was a copy of SuperCalc 4, which is getting so sophisticated that you can actually write games in it. Don't believe me? One of the SC4 demos is 'Blackjack'. Now don't ask me why anyone would want to write games (or even programs) in a spreadsheet, but it's impressive anyway.

Most application software (not least SC4) now at least makes use of colour if it's there. That's probably why NEC decided to bite the bullet and ignore monochrome monitors when it was putting together marketing packages for the Powermate.

Documentation

As well as having the new DOS 3.2 manual, the Powermate is supplied with an excellent setup manual, which tells you all you really need to know about connecting the Powermate together, expanding it, and so on.

Technical specifications

Processor:	80286 running at 8MHz with one memory wait state
ROM:	64k
RAM:	640k standard, expandable to 8Mbytes
I/O:	Centronics parallel, 9-pin RS232C serial (up to 9600 bps). CGA
Keyboard:	101 keys, including 12 function keys
Display:	CGA, optional EGA or NEC high-res 'Power Graphics'
Mass storage:	either two 1.2Mbyte floppy or one 1.2Mbyte floppy and one 20Mbytes hard disk
Operating system:	DOS 3.2

In perspective

The AT market is starting to specialise. No longer can companies afford to bring out yet another AT compatible, aim it at large corporate clients, and just wait for the units to sell. There are a lot more AT compatibles out there now than there were a year ago, and more and more manufacturers are trying to move out of the crowded middle of the pack.

ATs are not yet selling on price alone in the way that, say, PCs are. They are still selling to a relatively price-inflexible market made up of people who need (or think they need, or would like others to think they need) a more powerful computer than an XT. When the crunch comes — when the corporate clients think Taiwanese AT clones are good enough for business use — there will be the same sort of shakeout that is presently sending PC dealers to the wall.

Prices

The Powermate is not all that cheap, although I have no doubt that NEC dealers will discount it heavily, as they do with all other NEC products. Be that as it may, the recommended retail plus tax for the entry level Powermate (with, remember, colour monitor and twin 1.2Mbyte floppies) is $4860.

If you want a hard disk drive, it will cost another $865, and an EGA card will add another $461.

A system with NEC's 'Power Graphics' card and a suitable monitor, giving a total of 1120 by 750 pixels and 16 out of 4096 colours, with a hard disk will cost $8003.

Memory expansion is available, up to 2Mbytes per slot, giving a theoretical total of 8Mbytes.

Benchmarks

BM1	0.5
BM2	1.5
BM3	3.0
BM4	3.0
BM5	3.0
BM6	6.0
BM7	9.0
BM8	9.0
AVE	4.38

Conclusion

The Powermate is a neat machine, which will no doubt sell well. It has everything that you might need in an AT, takes up less room on your desk that other ATs, and is not extortionately priced.

In short, it should be a nice little earner for NEC.

END

Phil Cohen is a director of Hard Copy, a Sydney technical writing company.

Common carrier

Changes in the telecommunications industry will have a dramatic impact on future microcomputer design, with the telephone being the common carrier for voice, data and video transmission. Martin Banks dials in to air his views.

I seem to remember being told at some time that it is a function of advancing years that, after a while, the memory gets a bit dusty and things don't come through quite as brightly as they used to. I seem to be suffering from this problem already, for I seem to remember something a few years ago about a computer called 'One Born Every Minute' possibly from ICL.

It sticks in the mind simply because this machine was based upon a sound and original idea and then missed its target by a bit.

No . . . hang on . . . the fog is clearing. The machine did come from ICL, but the name was wrong . . . close, but wrong. The machine in question was (and still is, I suppose) called the One Per Desk, and marketed here by Telecom under the name of ComputerPhone. The sound idea upon which it was based was the simple one of connecting a computer (said OPD) to the telephone network as a means of communication.

One reason the beast missed its target was the fact that it was just a bit too early on the scene. If it were being designed now, rather than then, it would probably be quite different, if you see what I mean.

There is a reason for making this contention that goes beyond the mere fact that basing the beast around the guts of a Sinclair QL was not the most sensible option. *That* machine may have been a good theoretical design, but the world just didn't go that way, and neither did that many users. No, the reason the ComputerPhone would *now* be designed differently is that the nature of the telephone itself is changing in quite fundamental ways.

Such changes mean, of course, that new jargon has to be learned. The item in question is ISDN, which stands for Integrated Services Digital Network. (Well, well, I hear you say, so what does all this telephony stuff have to do with fun-loving, games-playing computer freaks — or for that matter most people who ever use a computer).

The nature of ISDN is that the telephone companies worldwide are merging the telephone networks into a coherent whole that will handle voice, data and even video all on the same line at the same time. This means, in theory at least, that we will be able to talk to someone on the telephone, anywhere in the world, and at the same time see them, if that is what we so desire, and transmit data to them; all of this done as easily and directly as we now work the current telephone system.The significance of this cannot be understated, for we are all guilty of using the telephone to call friends/relatives/business associates point-to-point virtually anywhere in the world — without ever considering the technology involved.

Now apply that same consideration to data transmission and things like computer communications software. Let me give you an example.

Being of advancing years it is only recently that I remembered I really ought to have a go at this Minerva thing, so I got a modem and some comms software out of Olivetti for my (now sadly obsolete) M21 and had a go. I also discussed the matter with the editor of *APC*, doing direct, point-to-point comms between us. After trying to work out where his comms software and mine touched, we decided not to bother and just to use Minerva instead. The telephone, as with speech comms, is already providing the common carrier through which different systems can communicate.

But ISDN takes this idea further. It provides a fully digital communication service for which modems will not be needed. All that 'yer-average PC' will require is a chip-set interface. That will gain you access to any other telephone socket, anywhere in the world. And those chips are now coming; indeed, many are now here and being designed into systems.

This may all sound rather fancy but this impending technology will have a considerable impact. Imagine, for example, the effect it might have on local area and wide area networks. Every day a new LAN product appears on the scene, each offering better bells and whistles than the last and all, to a greater or lesser extent, totally incompatible with any other system. The idea, of course, is that a company buys all its LAN products from a single source and gets nicely locked in.

Life, unfortunately for the suppliers, isn't like that too often, which is why many potential users are still deeply suspicious about LANs. In addition, the things just aren't flexible enough. For example, I write for *APC*, but I don't work in its offices, so it would be difficult and expensive for me to be part of any LAN (or indeed WAN) that the magazine established. I would need to have exactly the right hardware and software for a start; not so with an ISDN system. As long as it were compatible with the telephone system, *APC* and I could be in business with voice and data on the same line.

As this type of approach to system communications is taken up, it could mark the end of restrictive LAN systems as we know them. Everything will have to interface with the communications system, so that anything can talk to anything, regardless of the hardware or software being used, or its location in the universe.

When such things might happen is still very much an open question, for there are many vested interests at work. It is worth noting, however, that while IBM views the PC clone makers as a significant irritation to its unrevealed master-plans, it views the telecommunications companies as the *real* enemy. If the telephone system lets people with Commodore 64s communicate happily with IBM mainframes to achieve constructive outputs, then Big Blue will have lost its greatest prize — control of its own destiny. That, of course, might be no bad thing. . .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SCREENTEST

Bricklin's Demo

Aimed at the 'more technical market initially', Demo from VisiCalc author Dan Bricklin allows you to build a series of computer screens to produce high-quality prototypes of text-based programs. David Tebbutt assesses the product's value.

Dan Bricklin's Demo program provides a means of producing realistic prototypes of planned programs and convincing demonstrations of existing ones to run on the IBM PC and close compatibles. The process is fast and flexible and anyone should be able to produce professional results within a few hours of sitting down with the product. System developers can thrash out the user interface, in detail, before it is too late to modify it. Teaching or sales demonstrations of existing programs offer the obvious advantages. At $US99 and within the limits of what it sets out to do, the program is excellent.

Demo does not support bit-mapped graphics, so if your ambitions lie in that direction you can stop reading now. It does, however, support the entire IBM PC character set and its screen attributes displayed on the full 80-column x 25-line screen. For the record, I tested Demo on an AT clone with 640k memory, a CGA board with colour monitor and a Star NL-10 printer.

Overview

At its simplest, Demo allows you to build a series of computer screens, called 'slides', and move from one to the other under keyboard or timer control. Tones may be played along with each screen. It is possible to create music of a sort but it sounds so dreadful, it's better to restrict this facility to warning beeps.

For added realism, you can make the disk-drive light come on, even when there's no disk in place. You may also invite keyboard entry into a text buffer, the contents of which may be redisplayed later in the course of a slide show, for example. The facility is crude and should not be used for much more than getting people's names and thanking them, by name, for sitting through your demonstration.

> *'Demo allows you to build a series of computer screens called «slides», and move from one to the other under keyboard or timer control'.*

Demo is unable to test the contents of the buffer or, for that matter, to read the screen in any other way. This means that Demo is firmly in control of its own execution. The user can only progress according to the keys predetermined by the demonstration's author, so don't expect to build demonstrations and prototypes which behave exactly like real programs, with screens changing according to the user's inputs.

To save space in memory and to speed development time, Demo allows you to overlay screens one upon another while offsetting them from their original positions. A useful analogy is that of unframed overhead projector slides: Imagine a pile of transparent acetate sheets lying on your desk. On each is painted a computer screen. By laying one on top of the other, you build a composite picture of all those screen details which show through the clear acetate of those above.

Now start sliding individual sheets from side to side or up and down until the central part, the composite screen, meets your requirements. You may then decide that some sheets are at the wrong depth, that they obscure wanted details in lower sheets, so you change their depth in the pile.

Finally, you may decide that you want some of the higher level sheets to retain their own text or character graphics, but adopt the foreground and background colours of one lower down. This can't be done with acetate sheets but it can be done with Demo.

The programs

Demo comprises three main parts: Demo itself, which we'll come to later; a screen capture program; and a run-time version of Demo.

The screen capture program runs in the background and may be affected by other background programs, so it's better to have a reasonably clean machine to start with. You can always

experiment with the mix of background programs later. On loading Capture, you may define how much memory to reserve for the captured screens, from 16k to 255k. The default is 32k.

The Capture program is intelligent enough to economise on storage. I stored as few as three screens and as many as 295 in a 16k area. The three screens were fully occupied with different characters and different screen attributes in adjacent positions. The 295 were all empty screens with no attributes. I got 279 screens full of white on black 'X's into this same buffer.

Whenever you are working outside Demo and you reach a screen you want to include in your demonstration, simply press the two shift keys together. A low-pitched beep means the save was successful, a high pitched one means you're probably out of memory. The screen is stored in the buffer where it lies until you retrieve it from within the main Demo program.

Like all the Demo programs this one worked perfectly, except when it collided with other background programs. Since I run Smartkey, SideKick as well as other programs habitually, you can see why I took the coward's way out and simply avoided these programs for the duration of the test. Actually, I think SideKick was the problem because it can be woken up with the two shift keys.

The memory occupied by Capture and its buffer can be retrieved using CAPTOFF, leaving just a 128-byte 'marker' in the background program chain.

The run-time version, RDEMO, executes the slide sequence built but does not give the user access to the editing facilities of Demo. You may make up to fifty copies of the run-time version before either buying another Demo or by negotiating directly with Software Garden Inc in the US, Bricklin's company.

The Demo program

The entire Demo program and its screens or slides are loaded into memory at once. This means that, once loaded, it is possible to remove the program disk if necessary. If your demonstration requires more slides, then it is a simple matter to get one demonstration to call another from disk.

Menus appear in the Lotus 1-2-3 fashion with the ability to select a function with the left/right arrow keys or through its initial letter. The advantage of selecting with the arrow keys is that a brief description of each selection appears just below the menu bar.

The main functions of the Demo program are slide building, establishing control, global controls, input/output and macros. A simple help screen also pops up when you press control-H. This describes editing and function key usage. The function keys shortcut many of the more commonly used command sequences, often replacing as many as five keystrokes with one.

Macros

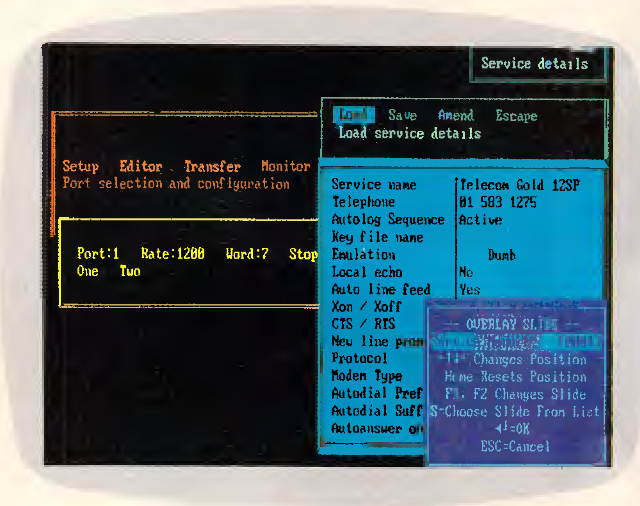
Users of Smartkey, Prokey and all the rest will know how useful these products are when you have tedious repetitive actions to perform. Well, Demo comes with its own simple keyboard macro facility which allows you to associate keyboard sequences to the ALT-O to ALT-9 and ALT-A to ALT-Z keys. You can also extend the sequences but you can't edit them. I found the facilities perfectly adequate and they helped me on a number of occasions.

For example, I wanted to create an animation sequence to see how smoothly Demo executed it. I put a small drawing in the top left-hand corner of the screen, put the cursor over it and then called up the macro command with SHIFT-F6. Once I had chosen ALT-A as the recipient of the macro, Demo then recorded every keystroke until I actually pressed ALT-A. Further depressions of the same key played back the entire recorded sequence.

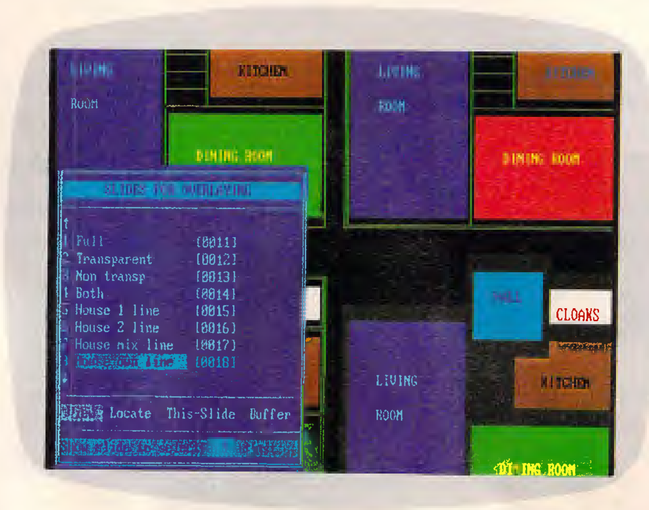
The macro approach took 39 keystrokes, including definition, instead of 336, and produced a modest animation effect. It could not be called smooth, as in cartoon animation, as it was a little jerky. I think by playing around with the distance travelled by the object on each slide, I could have improved matters, but I still feel sure that the goal of a truly smooth movement would still have eluded me.

Slide building

The easiest way to build a slide is to swipe it from somewhere else. I pinched some screens from a com-



Four slides overlaid on top of each other: the menu boxes and their contents are opaque, but the area outside each is transparent to allow underlying slides to show through



Although this shows slides being selected for overlaying, you will also notice the variety of line-drawing styles and area fill colours. Lines can be single, double or any character

munications program using the Capture background program. Then, in Demo, by pressing three keys, all the screens I saved in the Capture memory buffer were transferred into the Demo slide memory.

The alternative is to use the excellent onscreen editor built into Demo to create your own original slides. Nasty things like those hard-to-get-at special characters are made accessible through pop-up lists.

Foreground and background colours (from now on referred to as 'attributes') may be selected from a similar pop-up list but one which you build yourself. Each entry can be created by typing its hex code (ugh!), or by using the up/down arrow keys to cycle through the possible values. As each is selected, the attribute colours are displayed in a small rectangle to its right. I find it quite astonishing how grim the majority of colour combinations are, but once you've settled on a combination the rectangle is switched-off. You may name each attribute but it would have been so much nicer to have kept the coloured rectangles.

Information may be placed on a slide by typing, drawing, boxing, copying or overlaying. A typing attribute is set and these colours are used for all typing, special characters and line drawing, until the attribute is redefined. The black on black attribute, value 00, is treated as transparent by Demo, which means that a piece of typing on one slide can pick up the attribute of a slide lower down the pile. A curious facility lets you set the typing direction to up, down, left or right. Down I can understand, but up and left?

You can select single or double-line drawing, as well as defining your own preferred character with which to draw lines. Once the option is selected, lines are drawn by simply pressing the cursor keys. With the single and double lines, corners and junctions are taken care of automatically.

The pop-up character list lets you select any IBM character for display including a special transparent one, value 00. This causes a character in the same position on a lower slide to be displayed in the typing attribute active when the null character was selected.

Rectangular blocks are defined by selecting the two corners using the cursor keys and then using a fill command to flood the block with colour, with characters or with both. You can create transparent areas of colour which act as a sort of wash over underlying slides. You can also 'cut holes' in a slide by creating a block and then deleting (making transparent) its contents. You can also surround a block with a single or double-line box. Finally, if you define a block which contains text, you may centralise each line using the 'Centre' option.

'Demo's limitations centre around the fact that it's a text-only system and it cannot interrogate and act on the screen contents.'

The overlay facilities of Demo are powerful, easy to use and offer the most economical use of memory. If you look at the communications picture, you will see that it is comprised of four elements: three menus and one label. Each of these was drawn on a separate screen and the four screens used as overlays on a fifth, blank, screen. An overlay list was associated with the blank slide. As each slide was added to the list, the copy of the image was coloured and moved into position. Demo lays the slides down in the order of the list so that opaque areas on the last slide obliterate underlying details. It is a simple matter to rearrange the slide sequence.

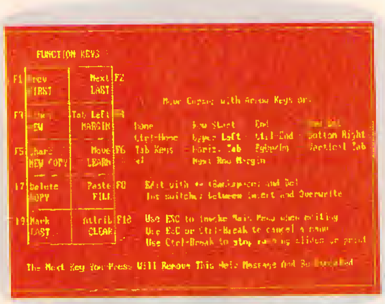
Slides may be copied with or without their overlays. The worst thing about copying is that it gobbles memory but it's quite useful if you want to experiment before finalising a slide layout. You may also cut and paste rectangular blocks between slides and even keep a library of those you're likely to use regularly.

Control

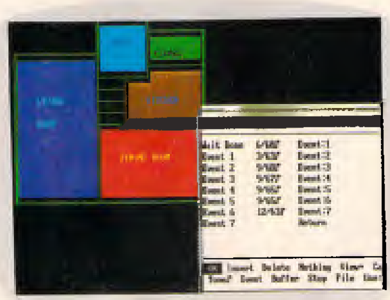
Once you have created your slide repertoire, or maybe even as you go along, you will want to decide how to move from slide to slide and what other activities are to be performed. Movement between slides occurs when certain keys are pressed or when a time interval has elapsed. Almost 180 different key combinations may be sensed and each could, theoretically, result in a different action. I used things like F1 to go to the previous slide, F2 to go to the next and ESC to abandon the demonstration. A global key handler can be defined which saves having to describe the key use for each slide. Demo looks at the slide's own handler list first, then goes to the global one if there's no match.

I could have put up menus, driven by initial letters or responded to arrow key movements. Demo does not normally use a genuine screen cursor, so it is up to you to display a modified version of each screen showing the new cursor position. A default timeout can be set to select the next slide after a delay of 0 to 16 minutes following the last key depression.

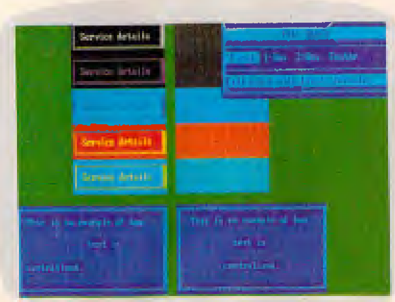
Individual slides in the demonstration



This is the only help screen, apart from the menus. It is of most use when you're trying to remember the function key allocations



The white box shows how tedious it is to write 'music'. This is seven notes from Brahms' Lullaby. Frankly, it wasn't worth the effort



Each 'Service details' box is an overlay. The whole block was copied to the right and, as you can see, only the attributes moved

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may be under key or timer control. The delay you can set between slides ranges from 0 to 56 minutes. As each slide is displayed, you can do things like playing tunes or switching the disk drive light on. See the screenshot for an idea of how tedious it is to write an eight-note tune. The other thing you might want to do is to allow the user to type something in. An 80-character buffer is provided and an appropriate line is placed anywhere on the screen. You can even define a hardware cursor to track the user's input. In any future slide you may display the contents of this buffer. And that's it. You can't test it. You can't limit the length of the user's input. In fact, it's about as useful as the 'music' facility.

You can load and run another demonstration file from the current one. It is loaded and control transferred to it. If you want to get back to the current file, you will need to tell the new file to reload the old one when it's finished. You can also call a slide to which control is transferred, getting back by issuing a Return from a subsequent slide. Up to 99 calls may be nested in this way.

You can test the likely outcome of your demonstration by running it from within Demo. The run option also has a Debug mode which shows the slide and handler details as each one is processed.

Global controls

A global menu gives details about the demonstration currently under development and lets you set certain defaults such as the timeout and the typing attributes. The most useful information is probably that relating to the memory used. The defaults can be changed and they are as follows: typing, cursor and background attributes; background character; menu background and highlighting attributes; overlays and timeout.

The cursor is displayed in its own colours except when it's over an area with the same attribute. Then it switches to the background attribute. The background is the equivalent of the surface of your desk in the transparency analogy. An empty slide will display a background colour and pattern as defined in this global menu. Generally you would make this a transparent attribute with space as the character, but for working out your screens and overlays you may find it helpful to use a real character and real colours. This is particularly useful when you are trying to keep track of transparent areas on slides.

As this review was being written, Philadelphia-based Genesis Data Systems announced its Screen Master demonstration program. Its design objectives were apparently the same as Bricklin's but the company claims to have achieved its results with a less fiddly user interface. The company admits that the program has no sound facilities, which almost counts as an asset. *APC* will obtain a copy of this product and bring you details as soon as possible.

Genesis described Bricklin's user interface as 'unnecessarily obnoxious' requiring the constant use of hexadecimal numbers and too many steps to accomplish tasks. Inevitably, I suppose, you have to slag off the competition but the remarks do seem excessive. Sure you can use hexadecimal numbers in Demo, but you don't have to. The 'too many steps' remarks would be reasonable if it weren't for the function keys for all common activities and the built-in keyboard macro.

Screen Master costs $US99.95 and is available from Genesis Data Systems, 5403 Jonestown Road, Harrisburg, PA 17112, USA. Tel: (717) 652 1200.

The Demo menus themselves may be changed. I accidentally set the foreground and background the same and couldn't see what I was doing for a while. I'm sure it wouldn't be too difficult to include a trap in Demo for such obviously ridiculous settings.

Sometimes you can get in a real muddle with overlays. You stack up a pile of slides and you want to change something but you can't remember which is the current slide and which bits are overlays. The 'overlays off' option allows you to view the slides without their overlays while you sort yourself out.

When you have a set of parameters which you like, it's best to save them in a file called INIT. This will be loaded automatically whenever Demo is loaded without specifying a file name.

Input/output

The Save and Load facilities are very much what you'd expect, including full pathname access. A variation of Load is called Add, which inserts screen images (no overlays or handlers) from another file after the current screen in memory.

Retrieve is the bit already mentioned which reads in screen images saved with the Capture program. That leaves the Print command which is really quite interesting because it allows you to output to disk or printer, changing the characters on the fly.

This means that if you are having trouble with the right arrow or the musical note (EOF and CR respectively), you can redefine them before they reach the printer or disk. This is called 'mapping' and each character can be changed into one or two new ones. The first is automatically followed by a backspace before the second is printed. In this way the right arrow can become '->'. Standard mappings provided with Demo are ASCII, C language and Pascal language. This enables you to output screens or part screens (the contents of the current box) in a form acceptable to your programs. In Pascal, each character is in Hex, prefixed with #$. In C, each character below 32 and above 126, plus backslash and quotes, is output in octal with a backslash prefix.

You can easily create your own printer mapping by scrolling through a pop-up list of 256 characters, adding a translation where appropriate. I knocked up one for my Star printer in about five minutes, putting real graphic characters where ASCII had substituted question marks, hyphens, crosses and vertical bars.

The print facility gives a number of options, ranging from printing nothing to printing slides, their attributes (interspersed or separate), slide identities, overlay lists, run details, handler details, cross references, page break, line feeds, trim rght, block printing and number of slides. Most of these are self-evident; the rest aren't that important except to say that you are given a remarkable degree of control over the content of the printout. Unfortunately, the form of the printout is pretty inflexible. If you choose line feeds in place of page breaks, you get a huge listing printed across every perforation. You may prefer to print to disk and sort the format out elsewhere.

Documentation

The 29-page manual is a dog. It's the sort of documentation which makes perfect sense once you have struggled up the learning curve alone. The information is all there, but it is so terse that it

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is difficult to extract the meaning. Here's an extract: *'This changes an overlay reference, which changes in appearance when the referenced slide is modified, to a fixed copy that does not change and which can be edited as part of the slide'.*

Don't be put off though, just be prepared for some needless frustration. Bricklin told me that Demo is 'aimed at the more technical market initially'. He can say that again. For those who weren't around in the VisiCalc days, Bricklin was co-author of that milestone spreadsheet program. Apparently, a separate tutorial is planned to help you find your way round Demo.

Conclusion

I can't make up my mind whether this is a product of naivete, ignorance or arrogance. Those who remember Bricklin as co-author of VisiCalc might be prepared to put up with a disk stuck to a piece of corrugated fibreboard accompanied by 29 pages of incomprehensible documentation. Most people wouldn't bother.

But Demo is worth the effort if you need to produce high-quality rolling demonstrations and prototypes of text-based programs. System developers will use it to illustrate their idea to users. Software publishers will use it to help sell their authors' masterpieces. And some people might even use it for bog-standard slide shows.

Demo's limitations centre around the fact that it's a text-only system and it cannot interrogate and act on the screen contents. Bricklin tells me that a graphics option is 'high on his list of development priorities' but don't hold your breath waiting. My guess is that a screen-interrogating system would get so complicated that you would need something like a programming language to drive it, and the generated demonstrations would become much more difficult to use as a result.

Once you understand what it's all about, Demo is easy to use and very fast. It costs $145, is not copy protected and you can copy the run-time version up to 50 times before incurring extra costs.

If you're of a technical bent and don't mind bad manuals, I can heartily recommend this product.

END

Dan Bricklin's Demo program is available from Database Network, 23 Small St, Hampton, Vic. 3188 Tel: (03) 597 0133

Amiga 2000

Commodore's efforts to penetrate the business market have so far met with little success. The specification for its two new launches, the A-2000 and the A-500, is very impressive and should guarantee the machines their rightful place in the market. Julian Rosen and Nick Walker look at the A-2000.

Almost twelve months ago, Commodore launched the Amiga-1000 in Australia amid a flurry of press hysteria proclaiming the machine as the 'shape of things to come'. The A-1000 is only now beginning to sell in reasonable numbers, but the software market is still looking distinctly sparse apart from numerous games and hackers' tools.

Initially Commodore discouraged games software for its machine and tried to push the A-1000 as a general-purpose business machine, but after disappointing sales Commodore decided to re-focus its attention on specialist vertical market niches. Despite this the machine has chiefly sold in two groups: affluent game-players and hackers fascinated by the machines powerful chip-set.

Now Commodore is launching two new Amigas in an attempt to capture both the business and low-end, home user markets. This Benchtest concentrates on the business machine, the Amiga 2000 (see March *APC* for a review of the Amiga 500).

With one 3½in drive and one 5¼in drive, the front of the 2000 looks like a peculiar hybrid machine

In order to give full IBM compatibility, Commodore now includes a PC/AT standard keyboard

Hardware

Externally the Amiga 2000 looks very much like an Amiga 1000 grafted on top of an IBM PC clone. The box is approximately twice the height of the 1000 and has a slighly larger footprint; the increased box size being dictated by the A-2000's ability to accept IBM PC/AT expansion cards. As is the case with PC/AT clones I found this system box too cumbersome to sit neatly on a desk-top and was disappcinted that there was no facility to stand it on its side underneath a desk.

The Amiga 2000 has inherited most of the 1000's fine collection of ports. These consist of: analogue RGB, left and right stereo sound, a serial port, a Centronics parallel printer port, an external floppy disk port, a keyboard and two joystick/mouse ports.

The serial port has lost its non-standard extra power lines and changed sex, which means that it now conforms to the original 25-pin RS232 standard. The original pin-out is maintained as a set of vertical pins on the PCB for manufacturers who have created peripherals for the old scheme. The DIN socket (originally designed for an external TV modulator) has also been taken inside and now needs a small PCB-mounted modulater. The two mouse/joystick ports and the keyboard socket have been moved to a recess at the front, which to my mind is the sensible place for such things. Unfortunately, for some peripherals the recess makes connection impossible. This is easily rectified by an extension cable which some entrepreneurial company will no doubt supply in due course.

Internally, everything has changed. The relatively simple two-level circuit board of the 1000 has been replaced by one large PCB that covers the entire base of the machine. The right-hand side of this board is covered by a 'disk cradle' which is capable of holding up to three storage devices. The top of this cradle will take two 3½in devices and beneath this can sit one half-height 5¼in device. These can be floppy disks, hard disks, tape streamers or any other device that be-

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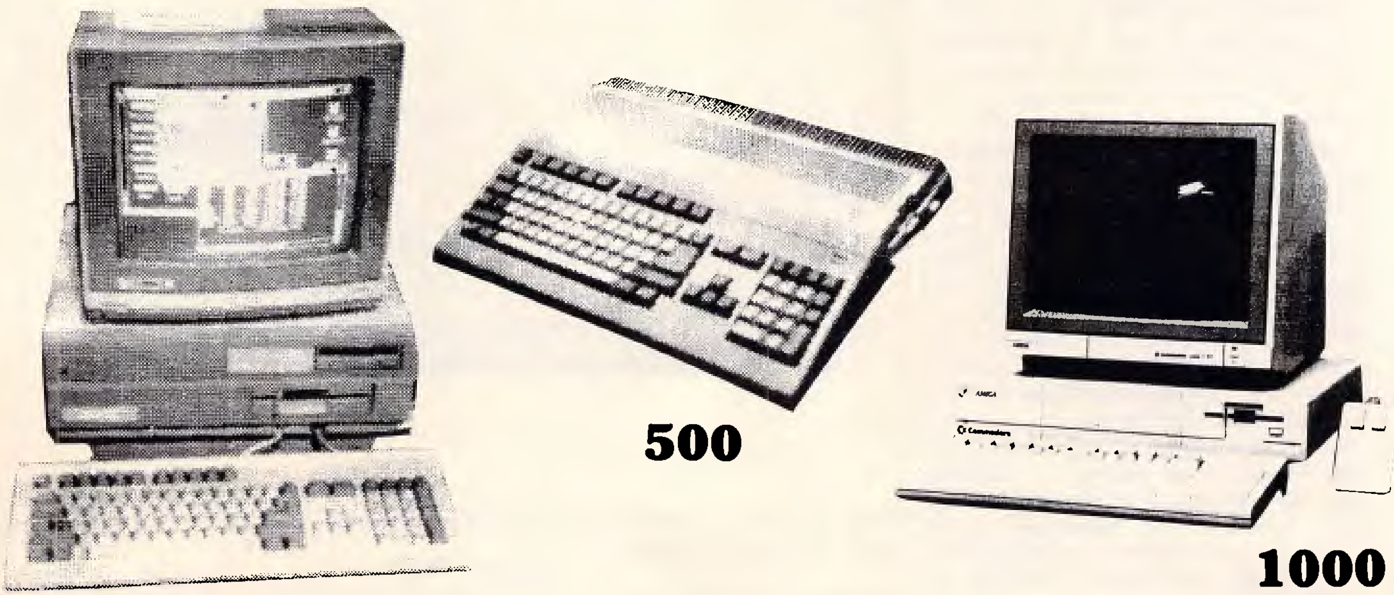

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haves like a generic storage device. The review machine had one 3½in floppy drive, one 3½in hard drive and a 5 ¼in floppy drive. I suspect that this will be the most popular arrangement as it gives maximum flexibility.

I was impressed when I first saw the Amiga's PCB, not particularly because of the quality, but because of the low chip count. On the A-2000 this chip count is further reduced by using larger RAM chips and integrating the control circuitry into fewer chips. The overall impression is one of a computer that consists of just four main chips, an enormous 68000 and the three fabled custom chips, Agnes, Paula and Denise. The processor is still a straight Motorola 68000 running at 7.159MHz and not the more powerful 68020 that many people were expecting.

The A-2000 comes with 1Mbyte of RAM as standard. On the review machine 512k of this was on an expansion card but after a few months production machines should have the full 1Mbyte on the main PCB. For the more sophisticated Amiga applications, such as real-time sound sampling, this is expandable to a maximum of 9Mbytes. Commodore supplies two internal user-configurable RAM cards. The 2Mbyte board comes with either 512k, 1Mbyte or 2Mbytes fitted and the 8Mbytes board with 6 or 8Mbytes fitted. ROM on the new Amiga has considerably increased as the 'Kickstart' operating system is now entirely in ROM. The previous Amiga had such a good system of loading the OS into RAM (once loaded, the RAM was totally write-protected, so Kickstart needed loading only once per session) that the benefits of having Kickstart in ROM will not be apparent. Having Kickstart in ROM reduces the number of disks needed to boot-up to one, which considerably speeds up the process and gives Commodore tighter control over issuing new versions. However, upgrades will now involve inserting a new ROM chip rather than simply a change of disk.

It is of course the custom chips that give the Amiga its real power. The three custom chips remain exactly the same in the new A-2000, and Commodore assures us that the only variation we might see in the near future is 32-bit wide versions which will operate in conjunction with the 32-bit 68020 processor. It seems that much confusion has arisen over exactly what these chips do, probably due to the diversity of each chip's function. (For a full explanation of their capabilities, see the original Amiga review in *APC*, August 1985).

We will, however, summarise the position briefly. Agnes is fundamentally the 'blitter' which means it can move and modify large areas of screen directly without affecting the processor. Because of its direct memory access (DMA), it has also been assigned the task of moving (not creating or monitoring) sprites and transferring disk data to and from buffers. A supplementary function of Agnes is that it also has the ability to draw lines into video RAM, once again without slowing down the processor.

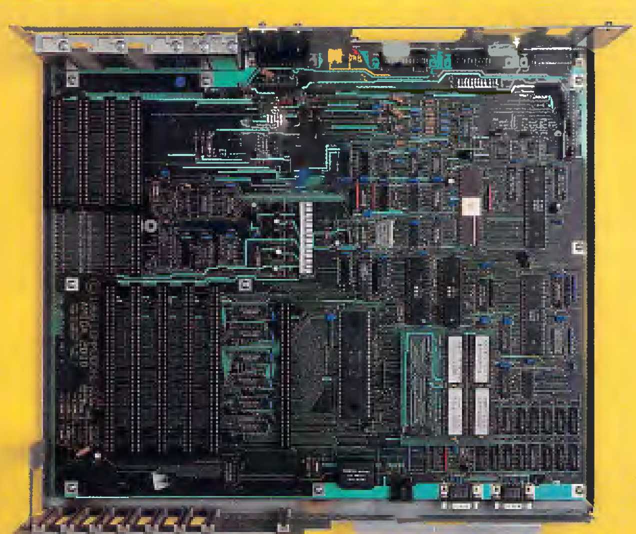
Paula, once known as Portia, has two main functions in life: looking after any peripherals, such as disk drives; and creating the Amiga's sound. Paula controls four sound 'channels'. These differ from the normal sound 'voices' in that a channel can produce a waveform and not just a frequency. This means that one channel on the Amiga is capable of simulating an entire orchestra compared with one voice

on other machines simulating one instrument.

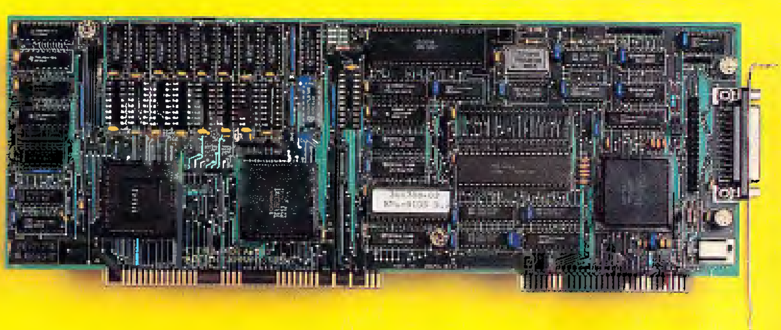
Finally, Denise, formally Daphne, controls all the non-blitter orientated video operations. These consist of display animation and sprites; and colour bit-plane control, including the fantastic hold-and-modify plane which allows you to change the colour palette as a screen is drawn, providing up to 4096 colours per screen.

One drawcard of the custom chips is that they can only operate on one particular chunk of 512k of RAM, known as chip RAM. However, this does mean that the remaining 512k and any expansion RAM is connected directly to the processor and can only be accessed by the processor at full-speed. This RAM is consequently known as 'fast RAM'. Overall the graphics and sound abilities of these chips are still unparalleled in the micro world, although the Apple IIGS's sound comes close.

The A-2000 has two overlapping bus systems, consisting of five 100-pin Amiga slots and four IBM PC slots. Two of the IBM PC slots are of the extended 16-bit PC/AT type. The IBM PC bus system is inactive until a 'bridge-card' connects the two systems at one of the two points of overlap and supplies the power to bring the IBM bus to life.



The Amiga's PCB is roughly divided into two: on the right there are two bus systems, IBM and Amiga; on the left, the processor and custom chips dominate the board. The IBM bus system does not come to life until a 'bridge-board' has been inserted



The technology of an IBM PC has now developed to such an extent that it can occupy half an expansion card

The review machine was supplied with an 8088-based bridge-card with all the supporting chips necessary to make this second processor a true IBM compatible. What Commodore has in effect done is to take the IBM PC Amiga add-on Sidecar and incorporate it into a single expansion card. The IBM compatible actually occupies about four square inches and consists of the Intel 8088 processor running at 4.77MHz, 256k of RAM, a floppy disk controller, ROM BIOS and even an empty socket for an 8087 maths co-processor.

The left-hand-side of the board consists of 128k RAM and the control circuitry necessary for the two machines to communicate. This hardware interconnection has been named Janus by Commodore as, like the mythical two-headed man, it looks back in time to the world of the IBM PC and forward in time to the world of Amiga. Computer companies have never been famous for their modesty! By using interrupts and semaphores (a form of software lock that stops simultaneous access to the same area of memory) to manage communications, both systems can operate completely independently of one another.

The video portion of the IBM compatible is mapped directly into the 128k dual-ported memory on the left-hand side of the card. As this mapping is done by hardware and is thus transparent to the IBM PC, the video display is compatible with both applications that use the official ROM BIOS calls as well as applications that write directly to the video memory. Meanwhile, software running on the Amiga can use the data contained in the dual-ported memory to create windows that emulate IBM PC compatible displays. The software provided with this bridge-board emulates both the monochrome and colour graphics adaptors of the IBM PC, monochrome in a true window and colour in a full-screen pull-down window. As the two adaptors use different portions of the interface memory, both displays can be emulated at the same time.

Once the IBM PC bridge-board is inserted all the IBM slots become expansion slots for this machine. All the expansion cards that I tried for this Benchtest in these slots worked

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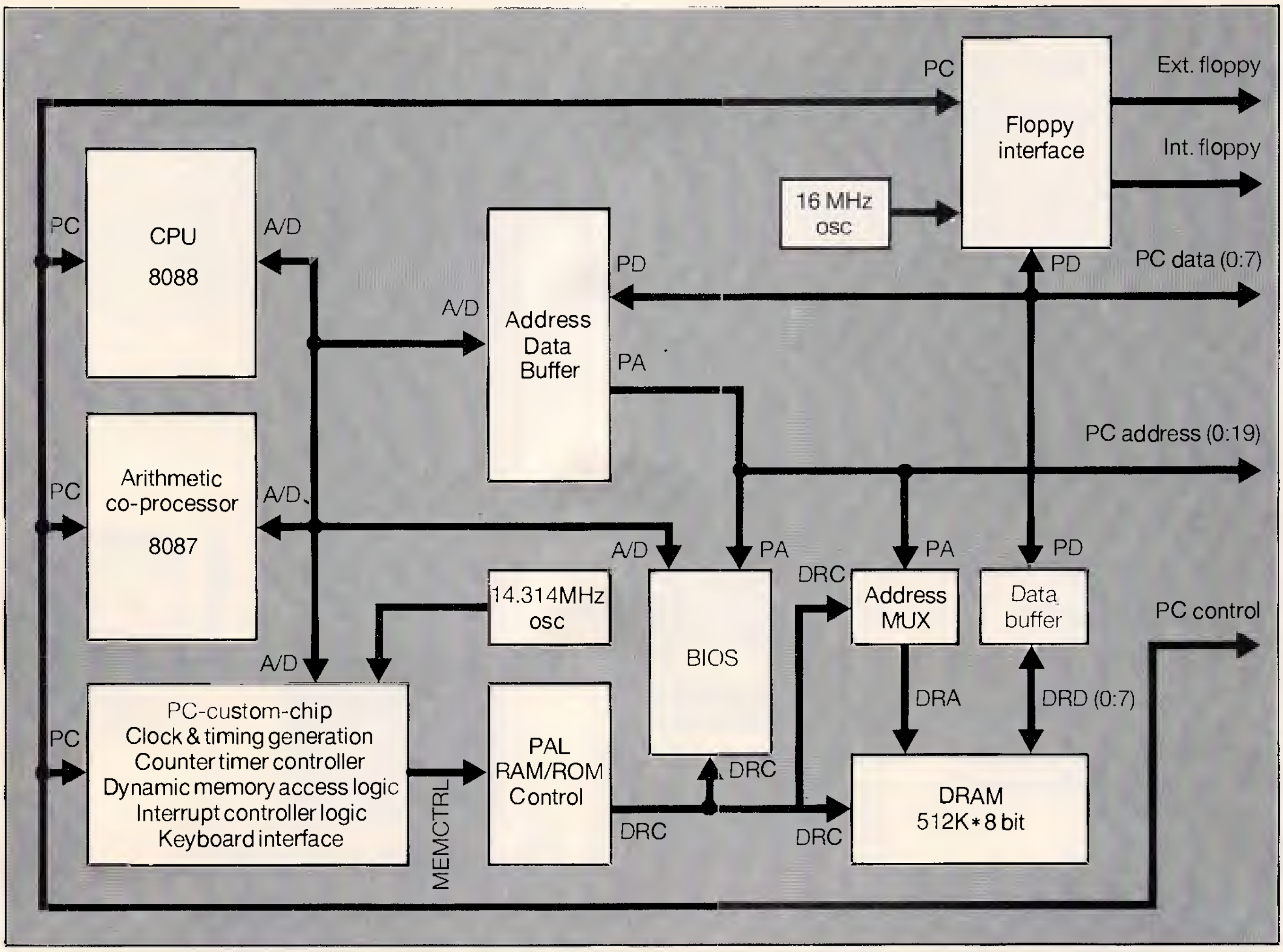

Block diagram of the bridge-board's architecture

without problems: however, graphics cards, and cards which offer serial and parallel ports, cause conflicts with the existing capabilities on the Amiga. I also suspect the use of a 286 fast processor card would be wasted as the 68000 on the Amiga would not be able to update the PC window fast enough.

A hard disk can be connected to the Amiga either directly or via the bridge-board. Hard disks connected via the bridge-board, including hard disk expansion cards, can be partitioned to give storage to both the Amiga and the IBM compatible. Operation on the Amiga side using this configuration will, however, be slower because data will have to pass through the dual-ported memory. The ideal solution would be to have two hard-drives, one connected directly to the Amiga and the second to the IBM compatible. The 20Mbyte drive on the review machine was extremely slow. After a long talk with CBM'S technical department it was discovered that the hard disk had been incorrectly formatted *and* it operated via the 'bridge-board'. After a brief spell with an alternative hard disk system, we found the hard disk entirely satisfactory on the IBM side but a little slow on the Amiga side.

In addition to the two bus systems, there is an 86-pin processor expansion slot which gives identical pin-out to the Amiga 1000's expansion port. In the long term Commodore sees this slot as the place for a more powerful processor such as the Motorola 68020; on the first A-2000 it will contain 512k of RAM. Manufacturers of peripherals for the A-1000 might also want to extend this slot's pin-out to outside, to enable them to be used on the 2000. A dedicated video slot allows you to fit products such as Genlock which means that you can super-impose Amiga text and graphics onto the picture from, say, a video-camera or a video disk player.

The majority of incompatibility problems with the original Sidecar add-on for the A-1000 arose because of differences between the Amiga's keyboard and that of the IBM PC. The A-2000 has a fully PC/AT compatible keyboard missing only the little used 'Sys Req' key. The cursor cluster is now separated from the numeric pad and the QWERTY sections, making the whole layout easy to use. The two Amiga keys are maintained in order to retain compatibility with the A-1000. In terms of feel the A-2000 is also an improvement over its predecessor, having a positive click when the key has registered rather than the dead feel of the A-1000.

No screen is supplied with the Amiga 2000, though at extra cost Commodore will supply the A1081 high resolution monitor.

A number of products are in the pipeline from Commodore but as yet none have firm release dates. Under consideration are two alternative bridge-cards, one containing a 386 or a 286 processor, possibly with EGA standard graphics. A 68020/68881 replacement is being developed by Commodore, although these are already available

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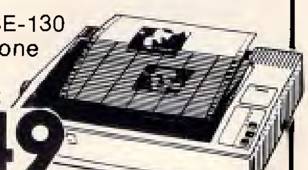

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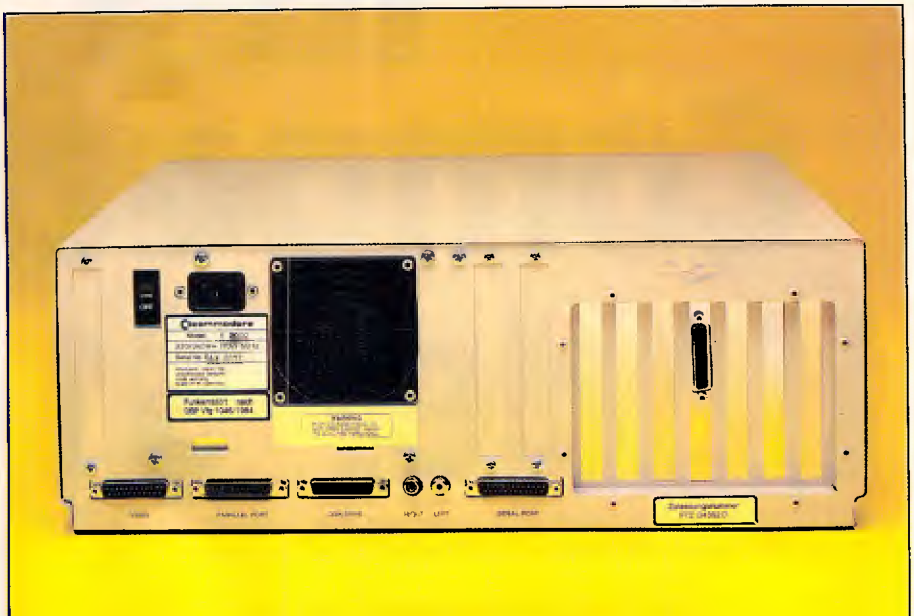
from the US at a hefty $1500. This board gives an impressive increase in performance, particularly if the application requires a lot of raw number-crunching. Genlock, the video overlay facility, is ready and a second more advanced unit is being produced for professional studio use.

System software

The A-2000, like the A-1000, uses a customised version of Tripos, transferred to the Amiga for Commodore by the software house Metacomco, and renamed Amiga-Dos. Existing Amiga users upgraded from Version 1.1 to Version 1.2 only recently and it is this that is contained in the A-2000's ROM. Version 1.2 corrects some minor bugs and introduces a new disk format that improves disk access speed in what it is an inherently slow but secure disk organisation.

AmigaDos is a true multi-tasking system which means that it's possible to run more than one application at the same time. While this is undoubtedly useful and the windowing system of the Amiga provides an ideal environment for it, it does cause some problems. My major concern is that having a number of applications running means that there is potentially more data to lose should the machine crash.

All too often with the A-1000 the whole system crashed and lost all the data from a number of applications. With Version 1.2 of the system software this seems to happen less



The Amiga 2000 retains the fine complement of ports of the original Amiga but they now conform to IBM PC standards

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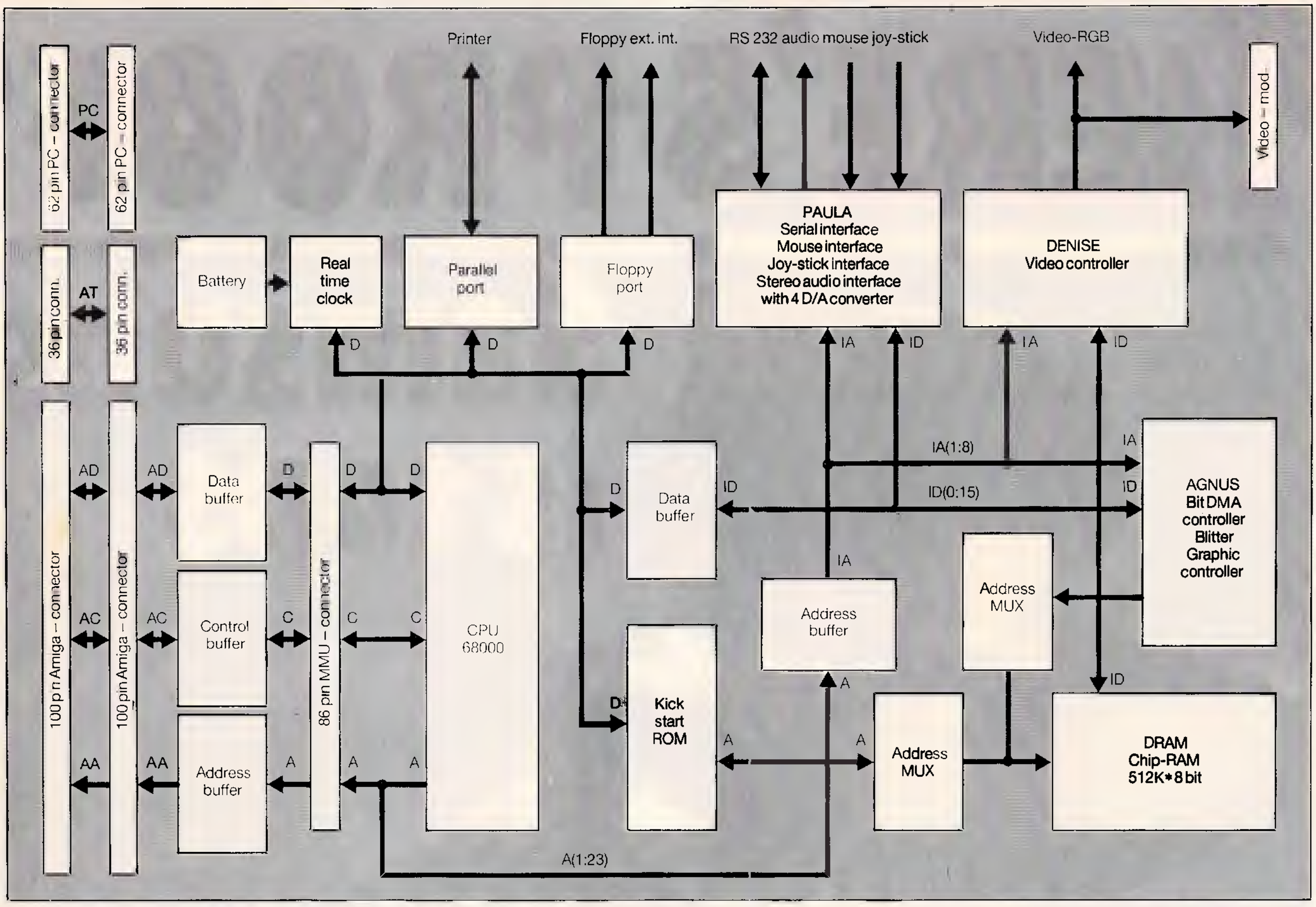


Block diagram of the Amiga 2000's architecture

often and when it does there is a very good chance that only one application will crash and the others will keep going. The only foolproof way of protecting one task from another is to have the protection in hardware of the 68020 processor in combination with an MMU (Memory Management Unit) or the 68030 alone would make this possible. However, a Commodore developer informed me that to use this hardware capability will require an extensive re-write of AmigaDos.

Intuition is the windowing interface for the Amiga and very capable of supporting the Amiga's powerful architecture. We found the screen appearance disappointing; the low-resolution, multi-coloured, chunky graphics desk-top is likely to put serious users off at first sight.

It is possible to run Intuition in high resolution but this is only feasible with an expensive monitor. No amount of customising from the Amiga's control panel could make the desk top acceptable to our eyes.

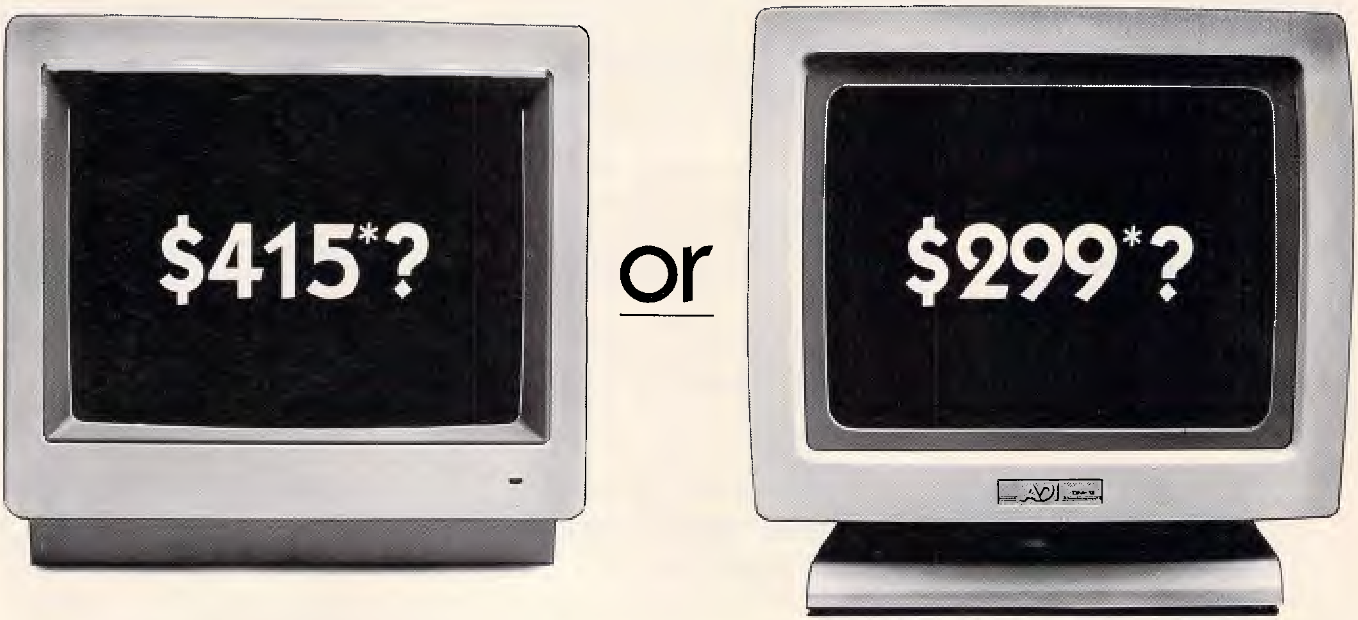
As well as Intuition, the windowing software, there are two extra pieces of software on the Workbench disk that are needed in order to bring the bridge-card into full operation. During system power-up, the Amiga executes its normal bootstrap procedure. While this is happening the PC performs an internal diagnostic program and then waits for the Amiga to tell it to proceeed. After the Amiga has placed a copy of its interface code in the dual-ported memory it tells the PC to continue. This allows the PC to install its local copy of the interface code. As soon as this has been done, inter-process communication is ready to run. All this is transparent to the user; all that is seen is the prompt 'Initialising Janus'.

> *'The majority of incompatibility problems with the original Sidecar add-on for the A-1000 arose because of differences between the Amiga's keyboard and that of the IBM PC.'*

Two icons on the Workbench labelled 'PC Monochrome' and 'PC Colour' represent the two Amiga programs needed to run IBM PC software. In order to load MS-DOS, the IBM PC operating system, it is necessary to run the monochrome software. An ordinary Amiga window will be created, in which will be the prompt for data that comes from the MS-DOS booting. All PC software, whether it be monochrome or colour, is launched from the monochrome PC screen. Ater initiating a colour PC application, expanding the PC Colour icon will open a colour screen containing the application.

The PC emulation windows come with a complement of menu functions which allow the user to modify and control the PC displays in ways that are unavailable to PC owners. New features include capabilities to modify and control the PC display's colours, and the ability to mimic multi-tasking displays by opening multiple windows into the video display, and then freezing the information contained on one screen by simply launching another. Also, an auxiliary tool is provided which allows you to grab ASCII data

What would you expect to see on a high resolution monitor?



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Technical specifications

Processor:	Motorola 68000 running at 7.159MHz
ROM:	256k
RAM:	1Mbyte minimum expandable up to 9Mbytes via internal expansion cards
Keyboard:	95-key, full-stroke including ten function keys
Mass storage:	Minimum one 3½in floppy expandable to hold any two 3½in devices and one 5¼in device
Size:	23cm x 49cm x 38cm
I/O:	Serial, parallel, video out and in, stereo sound, two joystick/mouse ports, two IBM PC expansion slots, three IBM PC/AT slots:
Operating Software:	AmigaDos (a version of Tripos), MS-DOS
Bundled Software:	Basic, desk accessories
Processor:	Intel 8088 running at 4.77MHz
ROM:	32k
RAM:	256k expandable to 640k via expansion cards
DOS:	MS-DOS 3.2

from a PC screen and paste it into an Amiga screen.

Application software

The last time I wrote about Amiga applications software, I was still waiting for a decent word processor, database and spreadsheet to be made available for it. I've now found the database in the form of Superbase from Precision Software but I'm still waiting for the word processor and the spreadsheet. There are considerably more applications of all forms for the Amiga, but in terms of serious business applications the majority are either poor IBM PC conversions that make little use of the Amiga's facilities or are needlessly gimmicky.

A vast number of games and programming languages are now available for the machine; and in theory the availability of good programming languages should mean that good applications will soon be developed. Unfortunately, my experience with existing users suggests the majority of software being developed consists of superb demonstrations of the machine's sound and graphics capabilities and very little else.

A number of small packages were bundled with the Amiga. These include a clock, a notepad and a calculator.

'in hardware terms the machine has everything going for it'

The only application that you could call in any way 'major' is Amiga Basic, which is Microsoft Basic compatible but includes excellent access to Amiga's sound and graphics and excellent structuring commands.

I tried a fairly extensive collection of IBM PC software on the bridge-board including Microsoft's Flight Simulator, Lotus 1-2-3, SideKick, GEM, PC-Write and a number of public-domain programs. Everything ran fine, although a number of applications that are capable of running in colour assumed a monochrome PC system and only ran in monochrome. On Sidecar it was possible to get round this by setting some dip-switches, but I could find no corresponding switches on the bridge-board. In the worst case a game called Digger refused to run because as far as it was concerned I was using a monochrome display. IBM PC compatibility of course opens up the largest collection of applications ever available on a single micro architecture, though most of these will seem somewhat crude to knowledgeable Amiga owners.

Documentation

No documentation accompanied the machine but two manuals will be available with production models.

Price

The A-2000 with 1Mbyte RAM and a single 3½in floppy drive will sell for $2999.

Options include two internal disk drives: 3½ in or5¼, both costing $299; a hard disk controller for $799 (which handles two standard ST506 hard disks and seven SCSI devices); 2Mbyte RAM expansion costs $899; and the 1081 monitor sells for $699.

Conclusion

There can be no denying that the A-2000 is very impressive in its adaptability, expandability and power. The internals of the machine make it the most versatile computer available in comparison with anything in a similar price bracket. In hardware terms the machine has everything going for it: large capacity drives, a good keyboard, expandability, excellent graphics and sound and IBM PC compatibility.

The Amiga 2000 is the most advanced micro you can have on your desk using current technology. However, it is good available software that sells machines and it is here that the Amiga falls down. The ability to run existing IBM software is nice but no-one will buy the machine on this basis alone, and so the A-2000's ultimate success will depend on the ability of Commodore to motivate software developers.

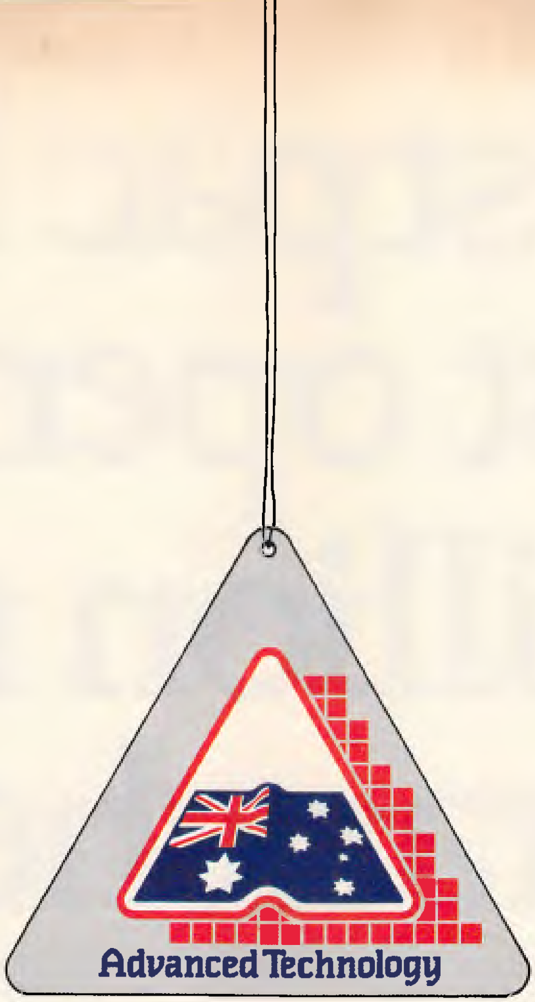
END

Benchmarks

	Amiga running Amiga Basic	**Bridge-board running GWBasic**
Intmath	1.7secs	6.0secs
Realmath	2.7secs	7.9secs
Triglog	6.7secs	44.7secs
Textscrn	150.3secs	96.7secs
Grafscrn	25.0secs	47.1secs
Store	16.2secs	9.7secs

The hard disk was incorrectly formatted; times for production machines should be significantly faster.

For a full page explanation of the *APC* Benchmarks, see the November 1986 issue, page 193



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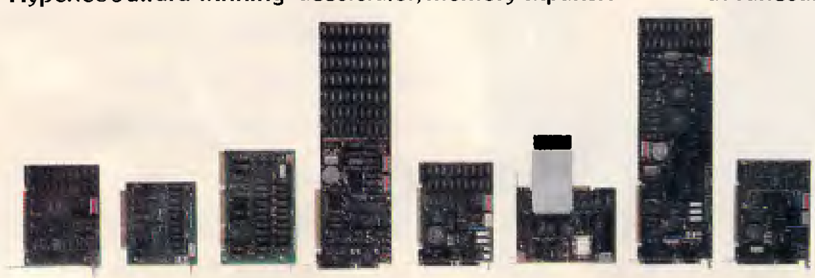

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Mystery & suspense

Who killed Celia? In the second part of his series, Mike Liardet explains how Prolog works and puts his theories into practice in the form of a murder mystery.

This is part two of our Prolog series. The first part appeared in the March 1987 issue of APC, copies of which are available from our Back Issues office at Computer Publications, 2nd Floor, 215 Clarence Street, Sydney 2000.

Understanding how Prolog works is probably the most difficult aspect of learning the language. Prolog uses techniques such as unification, backtracking and recursion, which are either non-existent or greatly underused in the more standard programming languages. Oddly enough, learning these techniques should prove to be less of a problem to the complete newcomer, who has nothing to 'unlearn' about programming languages, than it will to the experienced programmer who hopes simply to translate his existing programming skills into the Prolog formalism.

When all of Prolog's techniques have been understood, the rest should come fairly easily. It's well worth making an effort to get to grips with the way Prolog works, as everything thereafter should fall into place quite naturally.

In this article I'll show how Prolog can be used to solve a 'whodunnit'. This example gives an excellent illustration of Prolog's ability to represent deductions — clearly of great value in developing expert systems. This type of problem area is very open-ended, and there is ample scope for the reader to experiment and improve upon the rather inexpert detective encoded here.

Remember that all the example programs have been written in Turbo Prolog and may need some modification before they will work with other versions of Prolog. Most notably, the declarations at the top of each example (everything up to and including the word 'clauses') should be omitted from other Prologs.

Any readers who are unfamiliar with Prolog terminology are advised to refer to last month's article, 'Prolog power' where the basic definitions are given.

Prolog programs

When programming in Prolog, it isn't necessary to be obsessively concerned with the way the program will execute. For example, last month's homework, the route-planning program of Fig 1, was developed with little regard for the way it runs when faced with a query. For the route-planning problem, it was (almost) sufficient to verify the truth of each clause in isolation, and gloss over the details of how the clauses work in use. This rather unusual feature of Prolog is known as 'declarative programming'. In declaration programming, you concentrate on making declarations about the problem area, rather than how you want to go about solving the problem. But the result is the same — a program that will solve the problem.

```
domains
city = symbol
duration,takeoff_time_price = real

predicates
flight(city,city,takeoff_time,duration,price)
route(city,city,takeoff_time,duration,price)

clauses

flight(melbourne,sydney,12,1,160).
flight(melbourne,brisbane,11,2,243).
flight(melbourne,perth,10,3,369).
flight(sydney,wellington,10,3,634).
flight(wellington,papeete,11,5,1196).
flight(papeete,fiji,10,3,1246).

route(City1,City2,Takeoff_time,Duration,Price):-
flight(City1,City2,Takeoff_time,Duration,Price).
route(City1,City2,Takeoff_time,Duration,Price):-
flight(City1,Somewhere,Takeoff_time,Duration1,Price1).
route(Somewhere,City2,Takeoff_time2,Duration2,Price2).
Takeoff_time + Duration1 = Takeoff_time2,
Duration = Takeoff_time2 + Duration2 - Takeoff_time,
Price = Price1 + Price2.
```

Fig 1: modified route planning. Unlike last month's route planner, this one can also handle pricing enquiries

```
Goal : route(melbourne,Ans_dest,Ans_start,Ans_duration,Ans_price),
Ans_price  800.0.
Ans_dest=sydney, Ans_start=12, Ans_duration=1, Ans_price=160
Ans_dest=brisbane, Ans_start=11, Ans_duration=2, Ans_price=243
Ans_dest=perth, Ans_start=10, Ans_duration=3, Ans_price=369
Ans_dest=wellington, Ans_start=12, Ans_duration=4, Ans_price=794
```

Fig 2: Response to a pricing enquiry. This is the result of asking the route planner for all routes from Melbourne which cost under $800. The text describes how the program works when it is servicing this enquiry

Declarative programming is all very well, but it's still necessary for the Prolog programmer to have some understanding of how programs will execute. For example, in the second 'route' clause of Fig 1, if the route and flight goals following '-' are reversed, the clause will still be declaratively correct, but when it's used it will not always terminate. Without knowing how a Prolog program executes, it isn't clear why this should happen.

As with any programming language, the flow of control in a Prolog program moves from one executable statement to the next, in a logical fashion, as it is running. I'll now show how a Prolog program is executed, by describing the execution of the route-planning program as it responds to a particular command line query.

Execution

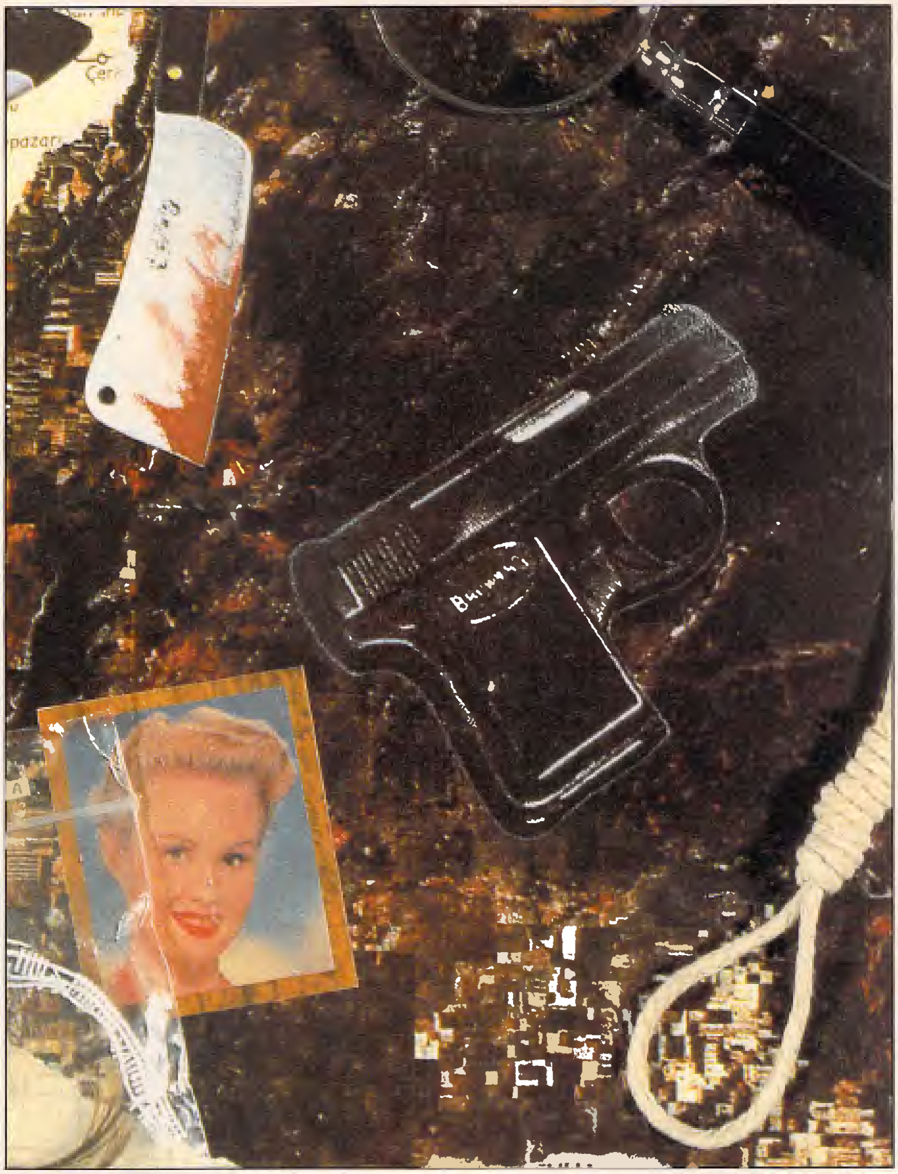
If your Prolog has a trace facility, you could use it with the route planner as you work through the following example. For Turbo Prolog, you just insert the word 'trace' at the top of the program and then select the 'Run' option, as normal. When tracing Turbo Prolog shows each step that a program takes. It will be easier to read the trace information if you enlarge the trace window, and the Turbo Prolog manual describes how to do this. You will also need to reduce the size of the other windows so that the trace window is not overlapped, otherwise the display becomes very confusing. When tracing in Turbo Prolog, you must continuously press function key F10 to carry on with the program's execution. However, be warned that, when tracing, Turbo Prolog does not display variable names as written in the input program, and also has a few other idiosyncrasies.

Suppose we give the route-planning program the following command line goals:

route(melbourne,Ans_dest,Ans_start,
Ans_duration,Ans_price),
Ans_price .0.

This poses the question of where can be reached from Melbourne for less than $800. If you try this command (initially without any tracing), you will see that it produces the results shown in Fig 2 — namely, four possible solutions, three of which are single flights, and the fourth which involves a connection.

Now try running the program again, with the same command line, but this time with tracing switched on. In the command line there are two goals; the



```
domains

   person,place,c_of_d = symbol
   time,strength = integer
   temperature = real

predicates

    victim_name(person)
    body_discovered_at(time,place)
    cause_of_death(c_of_d)
    body_temperature_at(time,temperature)
    finger_prints_found(person)
    suspect(person)
    lives_at(person,place)
    time_between(place,place,time)
    saw(person,person,place,time,time)
    physical_strength(person,strength)
    earliest_time_of_death(time)
    has_alibi(person)
    strong_enough(person)
    unexplained_finger_prints(person)
    whodunnit(person)

clauses
```

Fig 3: A Turbo preamble for solving whodunnit. This is not required in other versions of Prolog

first one will be tried — and must be successfully solved — before the second can be tried. There are two route clauses which may be of use in solving this goal, and the first clause is tried first. In order to be able to use the first clause, the 'route(melbourne . . .' goal must be matched with the 'route(City 1 . . .' head of the first clause. In this case, a match can be achieved if the variable City1 is set to melbourne, and City2 to Ans_dest, and so on.

In general, this matching of goals with clause heads can be quite complex (the technical term is 'unification'). It corresponds roughly to what happens in a conventional language when a function or a procedure is called: the argument values given in the function call are bound to the formal parameters — that is, the variables, specified in the function definition. In Prolog the goal is analogous to the function call, the clause is like the function definition, and the unification process is like the binding of parameters to argument values.

Following a function call in an ordinary language, the statements in the function are executed in place of the original call. In Prolog a similar thing happens. Following the successful match between the 'route-(melbourne . . .' goal and the head of the first 'route' clause, the sub-goals in the first clause are attempted (there is only one sub-goal in the first route clause). With the new variable bindings from the matching process, this will be:

flight(melbourne, Ans_dest,Ans_start, Ans_duration,Ans_price),

Notice that all that has happened is we have replaced the goal of finding a route out of Melbourne with that of finding a flight out of Melbourne. And re-reading the first route clause we have been using, we see that it specifies that one way of finding a route is to look for a flight.

The new goal is to find a 'flight-(melbourne, . . .' There are six possible flight clauses, and any of the first three will match. Prolog always attempts to match clauses in their order of entry, so initially only the first clause is used. The following variable bindings arise from this match: Ans_dest = sydney; Ans_start = 12; Ans_duration = 1; and Ans_price = 160.

Following the successful match with the head of the flight clause, its sub-goals would normally be attempted in turn. But of course there aren't any — the flight clauses are all 'fact' clauses. Consequently, the 'flight(melbourne . . .' goal can be deemed solved, and the 'route(melbourne . . .'goal from the command line is therefore solved as well.

After the solution of the first command line goal, the second and final command line goal can be attempted, namely:

Ans_price

During the course of solving the first command line goal, Ans_price received the value 160, so this goal is really that of showing:

160 .

This is, of course, true, and the built-in predicate for less-than allows the goal to succeed. This means that both goals on the command line have succeeded, the problem is solved, and the values of all the variables appearing in the command line can be displayed.

In most versions of Prolog, including Turbo Prolog, the system 'back-tracks' after successfully solving a command line query. It attempts to find out whether the problem can be solved any other way, until it has exhausted all possible solutions to the query. In this example, after it has derived the first solution, the 'flight-(melbourne . . .' goal is rematched with the second and then the third flight fact clauses, resulting in two more solutions (since Ans_price 800 still succeeds in both cases).

After the third solution, there are no further matches for 'flight(melbourne . . .' and the system needs to back-track further. The orginal 'route(melbourne . . .' command line goal is now matched against the head of the second route clause. The goals in this clause will finally succeed with the flight goal finding the Melbourne-Sydney flight and the route goal recursively using the first route clause, which finds the Sydney-Wellington flight. The system almost finds a Melbourne-Sydney-Wellington- Papeete route connection too, but it fails because the price is over $800.

You can see all the details involved in finding the fourth and final solution by following the trace display. As a paper exercise you can attempt to simulate

Murder at the mansion

At ten o'clock at the mansion house, the maid discovered Celia, the vicar's wife, lying in a pool of blood on the Colonel's tiger-skin rug. She had been horribly bludgeoned to death with a blunt instrument.

The maid, a frail, deaf old lady in her nineties, had been in service all her life with the Colonel's family. She said that she had gone to bed at 9:40, five minutes after the Colonel had set off for his regular weekly game of dominoes with the vicar. She had forgotten to put the cat out, and when she got up to do so she discovered the body. She phoned the police immediately.

Detective Pierre O'Log arrived at the scene of the crime at 10:10 and immediately took the corpse's body temperature, to determine the earliest possible time of death. He also did a thorough check for fingerprints. He then went straight to the vicarage to impart the terrible news to the vicar.

The vicar was in the middle of a game of dominoes with the Colonel, which they had been playing since 9:55. In spite of his grief, he gave a lucid account of his activities that evening. His unfortunate wife had left at 9:25, saying she was going to visit some parishioners. Neither he nor the Colonel knew why she had ended up at the Colonel's mansion. The Colonel had arrived at 9:50, and before he had even taken his coat off, Nigel, the local cad and lecher, had called at the door, asking for help because his flashy sports car had broken down. The vicar had charitably told him the local garage's opening time, and gone back inside to start his dominoes. The Colonel confirmed the vicar's story but had not seen who had been at the door.

O'Log then went immediately to the cottage where Nigel lived with his wife, Cynthia. Nigel remembered saying goodbye to Cynthia at the cottage at 9:30. He had been intending to 'go and have a few beers with his chums', but his car had broken down. He had called for help at the vicarage, but when none was forthcoming he had been forced to walk home. He arrived back at about 10:30, just as his wife was going to bed.

Cynthia, a rather robust lady, said that she had stayed at home all evening, mixing cement for a garden wall that she was building. She confirmed that Nigel had been out between 9:30 and 10:30.

The fingerprint tests revealed that the prints of the Colonel, the maid, Celia and Nigel were all present in the mansion.

Armed with all this information, Detective O'Log only needed to carefully measure the fastest possible journey times between the mansion, the vicarage and the cottage before he knew the murderer's identity.

the behaviour of this second route clause, by keeping track of all the variable values as each goal is solved. (Hint: rename all the variables in the first route clause to avoid confusing them with the variables in the second).

Having seen a specific example of the execution of a Prolog program, we can now summarise the general principles at work:

- All Prolog programs are started up by a problem statement, specified as a number of goals on the command line, and the Prolog system takes these goals and attempts to solve them one by one from left to right.
- The entire execution of a Prolog program is only concerned with solving goals. To solve a goal, the goal must first be matched with the head of a clause. When searching for a match for a goal, only clauses starting with the same predicate as the goal need to be considered, and a match is tried with each of these in turn, in the order they appear in the program.
- Following a successful match, the sub-goals, following the head of the matched clause are attempted, in the order they are given. After a successful match with a fact clause, there are no sub-goals to solve and the original goal, can be deemed solved, so a new 'waiting' goal can be tried.
- If, at any stage, a goal cannot match with the head of any clause, then backtracking ensures: an alternative match is sought for the goal that was solved previously. These alternative matches are sought only from the clauses that the previous goal had not already tried.
- In some cases a goal may make a call on a built-in predicate, rather than on a clause. As the name implies, built-in predicates are built into the language and are not defined by clauses written by the user. Goals involving built-in predicates can succeed or fail, just like goals for user-defined predicates.
- Eventually all the command line goals will be solved, otherwise the system will have to report a failure to solve the query. In many versions of Prolog, following the successful solution to all the goals, the system will display the values for the command line's variables and then go on to look for alternative solutions, and so on, until it has exhausted all the possibilities.

Armed with all this knowledge on how a Prolog program executes, it should

```
/* Victim is Celia */
victim_name(celia).

/* Body discovered at 10:00 in the mansion */
body_discovered_at(60,mansion).

/* Death caused by bludgeoning */
cause_of_death(bludgeoning).

/* Body temperature at 10:10 was 96.4'F */
body_temperature_at(70,96.4).

/* Specify whose finger-prints were found */
finger_prints_found(celia).    finger_prints_found(colonel).
finger_prints_found(nigel).    finger_prints_found(maid).

/* Specify the suspects */
suspect(maid). suspect(colonel). suspect(vicar).
suspect(nigel). suspect(cynthia).

/* Where everybody lives */
lives_at(celia,vicarage).
lives_at(ronald,vicarage).
lives_at(maid,mansion).
lives_at(colonel,mansion).
lives_at(nigel,cottage).
lives_at(cynthia,cottage).

/* Fastest possible travel time between key locations */
time_between(mansion,vicarage,12).
time_between(vicarage,mansion,12).
time_between(cottage,vicarage,18).
time_between(vicarage,cottage,18).
time_between(mansion,cottage,24).
time_between(cottage,mansion,24).
time_between(Anywhere,Anywhere,0).

/* Everybody's whereabouts...
saw(X,Y,Z,A,B) means X saw Y at Z
from 9:A until 9:B */
saw(vicar,celia,vicarage,0,20).   saw(vicar,colonel,vicarage,50,99).
saw(vicar,nigel,vicarage,52,52).  saw(maid,colonel,mansion,0,35).
saw(nigel,cynthia,cottage,0,30).  saw(nigel,vicar,vicarage,52,52).
saw(nigel,cynthia,cottage,90,99). saw(colonel,maid,mansion,0,35).
saw(colonel,vicar,vicarage,50,99). saw(celia,nigel,cottage,0,30).
saw(celia,nigel,cottage,90,99).

/* Everybody's physical strength rating...
1 = bed-ridden, ... 10 = built like an ox */
physical_strength(vicar7). physical_strength(colonel,4).
physical_strength(maid,2). physical_strength(nigel,8).
physical_strength(cynthia,5).
```

Fig 4: Facts extracted from the whodunnit text

```
earliest_time_of_death(Time) :-
     body_temperature_at(Time_temp_taken,Temp),
     Time = Time_temp_taken - (98.4 - Temp)*10.


has_alibi(Person):-
     body_discovered_at(Latest,Scene_of_crime),
     earliest_time_of_death(Earliest),
     saw(_,Person,Somewhere,Early_time,Late_time),
     time_between(Scene_of_crime,Somewhere,Travel_time),
     Latest < Late_time + Travel_time,
     Earliest > Early_time - Travel_time.

strong_enough(Person):-
     cause_of_death(bludgeoning),
     physical_strength(Person,Rating),
     Rating >= 4.
strong_enough(Person):-
     cause_of_death(shooting),
     physical_strength(Person,Rating),
     Rating > 1.
strong_enough(Person):-
     cause_of_death(poisoning).

unexplained_finger_prints(Person):-
     finger_prints_found(Person),
     body_discovered_at(_,Scene_of_crime),
     not(lives_at(Person,Scene_of_crime)).
```

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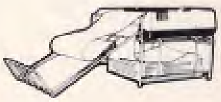

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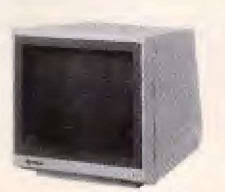

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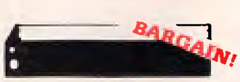

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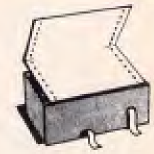

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```
whodunnit(Person) :-
      suspect(Person),
      unexplained_finger_prints(Person),
      not(has_alibi(Person)).
whodunnit(Person) :-
      suspect(Person),
      strong_enough(Person),
      not(has_alibi(Person)).
```

Fig 5: The detective part of the whodunnit solver. These are general rules which could be used with other whodunnits

now be possible to see why the second route clause will not terminate if its flight and route goals are transposed. If you can't see why, make the modification to the clause and try running it with 'trace'.

Whodunnit?

In the box entitled 'Murder at the Mansion", I presented a simple Whodunnit yarn in which I'll show how the culprit can be detected with the aid of Prolog. In some ways we can regard this as an exercise in building an expert system, where the expert being modelled is a detective. Perceptive readers will spot how woefully inadequate our Prolog detective is, and they are invited to improve upon it if they wish — there are a number of suggested improvements at the end of this section.

Figs 3 to 5 give the complete Prolog program to solve the whodunnit. To discover the culprit with Turbo Prolog, the three figures can be combined in a single program file, in the order given, and then run with the goal "whodunnit(X). .' For other Prologs the declarations of Fig 3 can be omitted, and the command goal ':- (X).' should have the required effect.

The clauses in Fig 4 are just facts, mainly extracted directly from the text. To economise on space, some essential facts such as the corpse's body temperature were omitted from the original text, but figures are given in the program listing. To keep things simple, time is represented in these clauses as the number of minutes elapsed after nine o'clock. With the help of the accompanying comments, the reader should have no difficulty in comprehending all these fact clauses, and can verify that they are all straightforward Prolog representations of information given in the text.

The clauses in Fig 5 constitute the expert detective's knowledge. These clauses could be used again and again with different whodunnits, the knowledge being general purpose and not relating to any specific crime.

The 'earliest_time_of_death' clause calculates the earliest possible time of death, given the body temperature and the time at which it was taken. The clause asumes that the body temperature falls by at least 1° Fahrenheit every ten minutes.

The 'has_alibi' clause states that a person has an alibi — if he or she were seen somewhere by someone else, at such a time that they could not possibly have been at the murder site during the period in which the victim was killed. The exact time of death is not known and is taken to be any time between the earliest possible time, and the time of discovery given in the narrative. To be in the clear, the person must have been unable to reach the murder site any time during this period. Notice that the 'saw' goal in has_alibi has an underline character in the first argument position. This indicates that we don't care who *saw* the person we are trying to give an alibi, and he doesn't figure anywhere else in the clause. The same effect could be achieved by using an arbitrary variable name like X, but it is considered good programming style to use the underline.

The 'strong_enough' clauses are used to determine if a person were strong enough to perform the murder. The first clause states that a person with a strength rating of four or more is required for murder by bludgeoning; for shooting, a strength rating greater than one is needed; and anyone is strong enough to kill by poisoning. For this particular whodunnit only the first clause will be used, because the death was by bludgeoning. The other two clauses will always fail on their 'cause_of_death' goals.

The 'unexplained_finger_prints' allows

Homework

Write a Prolog program to generate the following output, displaying '****' for negative square roots:

I	COS(I)	SQRT(COS(I))
0	1.00	1.00
1	0.54	0.73
	. . . etc . . .	
12	0.84	0.91

Solution to last month's homework: flight connections with pricing

Last month I introduced a simple route-planning program and left, as 'homework', the problem of augmenting it to handle pricing enquiries. Fig 1 shows one way of doing this.

In Fig 1 the flight and route predicates, which originally expressed relationships between four things, have been augmented to express relationships between five things. In their new form they still relate city of departure, city of arrival, take-off time and duration, as before. But now they also include price.

From the program given last month, all references to the flight and route predicates have to be augmented with an additional argument for the price information. This also applies to the basic flight fact clauses and the declarations at the start. The prices for route connections also have to be summed, since the price of a sequence of flights is the sum of all the constituent flight prices.

Finally, the calculation of a route duration has been modified. In this version, duration includes stopever times, not just the time spent in the air.

Armed with these modifications, the program can now readily handle queries like: which flights arrive in Sydney before 14:00 and cost less than $200; and where can I go, from Melbourne, for less than $800?

The command line goals to handle these queries would be:

flight(Start,sydney, Takeoff_time, Duration,Price)
Takeoff_time + Duration 13,
Price 200.
and
route(melbourne,Ans_dest,Ans_start,Ans_duration,Ans_price),
Ans_price 800.0.

As an exercise, try to invent further queries to test the new program, and add further flight clauses to extend its rather limited 'database' of six flights. Make a copy of the program in Fig 1 first, as we'll be using it again.

suspicion to fall on anyone not living at the scene of the crime, but whose fingerprints are found there. Notice the use of 'not' in the last goal; this attempts the goal within (in this case, 'lives_at(Person,Scene_of_crime)') and reverses the result. If the goal was successful, then 'not' fails, and if the goal failed then 'not' succeeds. In this case, the attempt at the goal within is completely straightforward since the 'lives-at' clauses, and the relevant lives-at fact is either there or it isn't. In general, 'not' can be used on goals of any complexity.

The 'whodunnit' clauses give two alternative ways of determining the culprit. They both require that the culprit be a suspect and that he doesn't have an alibi. The first clause points the finger at any suspect without an alibi and with unexplained fingerprints; the second clause acuses any suspect without an alibi who was strong enough to do the murder. Depending on the particular whodunnit being investigated, either or both clauses may produce any number of culprits — and a more sophisticated program might be needed to sort out the most likely villain. For this whodunnit only one culprit is unearthed, by the second clause. Try the goal 'whodunnit(X).' to determine who it is.

As I have mentioned, the Prolog detective here is unashamedly a rather poor one: everyone's statement is believed, even the murderer's. The basis for calculating the earliest possible time of death could include other factors: the effect of the room temperature on the body's heat loss; when the victim was last seen alive; and so on. There is no accounting for motive, or deductions concerning a possible murder weapon. The reader is invited to improve on the program here in whatever direction they choose — it's all good Prolog programming practice!

Conclusion

In this article I have given an overview of the way in which a Prolog program is executed, and also shown how Prolog can be applied to ,a fairly complex reasoning problem, with a flavour of expert systems.Many of the features of Prolog have been dealt with: clauses, predicates, variables, constants and arithmetic expressions. It should be possible to program interesting problems using these skills.

END

Next month: List processing

Mac II and Mac SE

The Macintosh has been dismissed by serious programmers as no more than an executive toy, but the introduction of the Mac II and Mac SE to the family should dispel such criticism. Based on an open architecture, the field is now wide open to third-party suppliers. But will slots and colour really establish the Mac standard? Robin Webster puts the new machines through their paces.

Well, it has happened. About three years after the original 128k model was launched, Apple Computer has decided to take the chastity belt off its Macintosh technology with the introduction of the completely 'open' Macintosh II computer and the one-slot Macintosh SE (System Enhanced). The main part of this Benchtest is devoted to the Mac II, but there is also a section on the Mac SE. Before I go ahead, it might be useful to give the reader a quick rundown of what to expect from these two machines.

Clearly the most advanced system is the Motorola 68020-based Macintosh II; it not only supports a 13in colour monitor, but also earns the title of 'open Mac' in that it provides six internal slots for add-on cards. Many developers are said to be already working on specialised cards, including one company that intends to market Intel 8086 and 80286 co-processor boards that will enable the Mac II to run software designed for IBM PC systems (see below).

In appearance the machine is no longer Mac-like. Instead there are now separate units for the system, monitor and keyboard.

The second new machine, the 68000-based Macintosh SE is the next step up from the current Macintosh Plus computer and it retains much of the original Mac's design. The major external change is that there are now two disk drive slots in the front instead of one. In one configuration both slots are occupied by 800k floppies. In the other configuration there is one 800k floppy behind the lower slot and an internal 20Mbyte SCSI hard disk behind the top slot (the slot is blanked off by the front plate of the hard disk). By completely redesigning the inside of the Mac SE, Apple has managed to find space for one internal add-on card slot on the motherboard.

The route from the 'closed' to 'open' Macintosh has been a fairly long and rocky one for Macintosh users.

The breakthrough hardware design of the original 128k Macintosh — a one-piece system unit/disk drive/monitor with only the mouse and keyboard as separate components — was an important part of its appeal to those who were frightened by or fed up with the 'build-it-yourself' approach encouraged by most other major personal computer makers.

There were no boards to install, no switches to set, no bundles of cables with different end connectors to come to terms with: you just hauled the Mac out of the box, attached the keyboard, mouse, and power cable, and switched it on. To get going you then inserted the complimentary MacWrite/MacPaint disk and started work. But this all-in-one notion had its own set of drawbacks.

As more and more serious applications appeared, users quickly found themselves constantly frustrated by two major obstacles: the 128k internal (and essentially off-limits) memory and the single 400k disk drive. Which early Mac user does not remember those sessions spent copying large files with one drive, and the increasing tension as you were asked yet again to insert one of the disks? Or what about those other times when you tried to load the latest version of a document only to be told that the Mac didn't have enough memory to complete the task?

Solutions to these two problems first came not from Apple, but from third parties that disregarded the computer maker's dire warnings about what would happen if they, as unauthorised companies, opened up any Macintosh.

First of all there came memory upgrades that could boost the Mac's RAM to between 512k and 1Mbyte. These upgrades sold like hotcakes.

Secondly, some of the more daring companies started installing internal hard disks (such as the Hyperdrive) that simply clipped onto the Macintosh system board.

With a decent amount of memory and hard disk storage available, business applications began to appear for the Mac at an ever increasing rate and the machine began to lose some of its 'plastic toy' image.

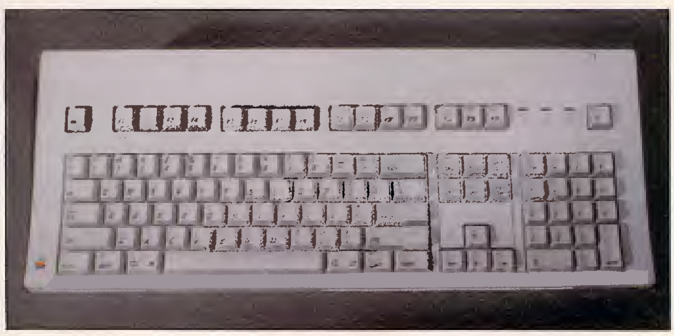
But it wasn't until the Macintosh Plus appeared last year that users began to see a real future for the machine in the business environment. The Mac Plus came with 1Mbyte of memory as standard, an internal 800k drive, and a new ROM that smoothed out some of the wrinkles of the machine's prior performance. The new SCSI (scuzzy) port with its parallel data transfer also allowed high-performance hard disks to be attached for the first time.

Despite all these considerable improvements, most Macintosh users have maintained a 'wish list' of features that they someday hoped to get from the Mac. Let's see what the Mac II strikes off your list.

Hardware

Unfortunately, the first thing that had to go when Apple decided to design an 'open Mac' was the concept of a one-piece system/monitor/disk drive unit that could be (fairly) easily toted from

The Eastwood is one of two new Apple keyboards. It comprises 81 keys including a 10-key numeric pad. Note the large on/off switch to the top left



The Saratoga keyboard is larger and comprises 105 keys. These include 15 function keys- useful for IBM-style applications

place to place. There clearly wasn't enough room inside a Mac box to put in all the pieces (see section on the new one-slot Macintosh SE).

As a result the Macintosh II has ended up similar in design (and even in its grey-white colour) to the recently announced Apple IIGS computer: it features a separate system unit, monitor, keyboard and mouse. The system unit measures 13.9cm high x 47.3cm wide x 36.4cm deep. Despite the fact that all the lines are straight and the corners square, the system unit is quite pleasing to the eye.

By itself the Mac II system unit weighs between 10 to 11kgs, depending upon the options installed. The colour display and the swivel mounting that it sits on account for about another 15kgs, so it is fairly *weighty* — the kind of system that will stay where you put it.

To the left of the front panel there is a small green LED that indicates when the power is on. To the right there are two 3.5in floppy disk drive slots set side by side (along the small holes required to allow the insertion of a paper clip or other similar probe in the event that a disk jams and has to be manually extracted). Apart from the name tag, that's all there is to see on the front.

Since the motherboard is placed lowdown inside the system unit, all the input/ouput connectors appear along the bottom back edge. From left to right they are: the on/off switch; the stereo sound jack; two Apple Desktop Bus (ADB) connectors (4-pin); two serial ports (8-pin — still a non-standard version of S5/8); and one external SCSI disk connector (DB-25). To the right of the SCSI port are the six NuBus expansion card slots which are closed off with push-in plastic panels when not occupied. Finally, the rightmost back edge has one main power inlet above which there is a monitor power cord socket.

Anyone who has had to worry about whether or not the country they are travelling to has a power supply compatible with their computer equipment can relax with the Mac II. Rather than having just one major design which is then later adapted for foreign markets, Apple has decided to provide the machine with a self- configuring power supply that can handle between 90 to 270 volts AC and input frequencies of between 48Hz to 62Hz. This a nice touch that removes one of the major hassles of using computer equipment in different countries.

While Apple used a third-party (Insonic) music synthesiser chip in the IIGS, it opted to design a custom sound device for the Mac II called the ASC (Apple Sound Chip). While the original Mac speaker sounded a little bit as if someone were holding a handkerchief over it, the standard Mac II sound ouput is really pretty good and has been enhanced by a sound 'baffle' underneath the system unit that is intended to project speaker output directly towards the user. Technically, the chip is capable of handling four individual voices in single channel mode or, by means of the special onboard stereo sampling generator, the ASC can drive external stereo equipment (speakers, headphones, and so on).

The ASC has a FIFO (First In First Out) as opposed to a LIFO (Last In First Out) architecture; that is the first unit of data read into the chip will be the first out. The combination of this FIFO architecture, a 1 kbyte onboard data buffer, a large amount of internal RAM, and the 68020 CPU means that music data can be fetched, processed and played very rapidly.

A good demonstration of how this arrangement can be useful to those who want to develop music with the Mac II came while I was using the original review machine. It was hooked up to a couple of Bose stereo speakers and these sounded marvellous when used to play back a selection of standard music demo files or even some realtime fooling around on an onscreen piano-style keyboard. It was only during one particularly long and complicated piece that I noticed the 'loading from disk' message regularly appearing in one of the music program dialogs.

The Mac II was actually loading a section of music, playing it and then immediately going back to the hard disk for the next section. There were no giveaway variations in the music output to indicate that this was happening. Impressive stuff.

If you really want the best sound possible, though, you will want to hook the Mac II up to external MIDI equipment and music synthesisers. The Mac II does not itself feature a MIDI interface that can be linked directly up to music synthesisers, but it can be made to send/receive MIDI interface compatible signals via one of the serial ports.

The two serial ports, handled by a Zilog 8530 controller, provide synchronous and asynchronous support for the Appletalk network system.

The SCSI connector is the standard 25-pin interface that supports 8-bit parallel data transfers at around 1.5 Mbits per second.

The Apple Desktop Bus (ADB) is a low-speed data bus which operates on the master/slave principle. The Mac II CPU acts as the master and all ADB connected devices — up to 16 devices, such as keyboards, mice and graphics tablets, may be daisychained — act as a slave to it.

Whenever there is an ID conflict among the various devices attached to the ADB circuit, the Mac II can resolve the situation by assigning new IDs to the relevant devices. The new IDs are only assigned and maintained during a single working session. The practical application of all this is that, for example, a teacher can control the main system while up to 15 students use keyboards on the same ADB circuit, or many people could simultaneously use mice to play a multi-user game.

Whereas the 128k Mac could only be opened by upgrade artists using an extra long screwdriver with a star bit to reach the recessed screws, the Mac II requires the use of only two fingers. Two small tabs protrude out of the top edge of the system unit on the back. By simultaneously pressing both in and lifting upwards, the lid comes free to reveal a neatly laid out interior. It's worth noting that, in keeping with the automated manufacturing process used in building the original Mac, the Mac II's internals have been engineered so that they can be dropped, aligned and fastened into place by factory robots. There is a real benefit to the user from all this careful design work — it doesn't take much brainwork to figure out how to disassemble the machine if it ever becomes necessary (that is, replacing a disk drive or adding more memory).

To the front right of the inside is space for two floppy drives — one 800k drive comes as standard. These are the usual Sony 800k double-sided drives and they will, therefore, accept and read disks prepared on any other Mac (there was no word on the possibility of eventually using the 1.6Mbyte drives that are currently being produced by Sony). Behind the floppy drives is mounted the optional SCSI hard disk (20, 40 and 80Mbyte SCSI models).

The Apple SCSI drives on the Mac II operate at the ideal interleave ratio of 1/1 and this makes them very fast indeed. In comparison, the hard drives on the Macintosh SE and the Mac Plus run at interleave ratios of 2/1 and 3/1 respectively. Apple is offering options of 20, 40, and 80Mbyte SCSI hard drives for internal or external attachment; the review machine was equipped with a 20Mbyte model. The

good part of all this is that applications and files load and run faster and the Mac 'wrist-watch' icon is around for much briefer periods than you may have become used to. The chore of waiting to return to the Finder after using an application is also a thing of the past.

The floppy and hard drives are mounted on a single sheet of aluminium that is itself mounted to the main system chassis by only about four screws. By removing these screws you can push the drive aside and gain access to the motherboard with its 68020 chip, 256k ROM (up from 128k on the older machines), and RAM chips.

Closest to the front of the motherboard are the Motorola 68020 32-bit CPU and the standard Motorola 68881 floating-point co-processor. Immediately behind the 68020 lies the socket for the optional Motorola 68851 memory management unit which is required if you wish to run Unix on the Mac II. If you really want to get an idea of how fast the Mac II can be, just get a demo of the system running a piece of software that supports the 68881 co-procesor — its performance is nothing short of stunning compared with a Mac Plus or Mac SE.

The ROM and RAM chips are located towards the back of the board near to each other. Apple has decided to go with surface-mounted 256kbit RAM chips to provide the standard 1Mbyte of memory, but this is expandable to 8Mbytes on the motherboard by replacing the 256k modules with 1Mbit chips. If you want to go further than that you must look to the six NuBus add-on card slots located between the disk drives and the power supply which can be used to push the total memory capacity beyond 2Gigabytes.

The six expansion card slots provided

Macintosh SE review

Although the Macintosh SE still looks very much like a Macintosh Plus from the outside, the only main design features that the two machines have in common are the 68000 CPU and the 9in monchrome video tube. Everything else has undergone a major redesign.

At a glance, the most interesting features of the SE are that it is between 15-20 per cent faster than a Macintosh Plus,. it has a 20Mbyte internal hard disk option, and it features a single internal expansion slot.

Although you can consider the Mac SE to be a 'bridge' between the Mac Plus and the new Mac II, you should be aware that you cannot upgrade your current machine to be an SE since the hardware differences are so extensive.

Hardware

The most noticeable changes to the original Macintosh casing are that it is now the same grey-white colour of the Mac II and that there are two drive slots in the front panel.

Externally the Mac SE is similar to the Mac Plus, but the drive slots are now stacked on top of one another rather than side by side (although the upper one here is blanked off). Inside is another story . . .

The slots are arranged one above the other rather than side by side as on the Mac II. They may be used for two 800k drives, or the top slot is blanked off when an optional 20Mbyte internal hard disk in installed.

The keyboard connector is no longer located at the front of the machine. Instead the keyboard is plugged into one of the two Apple Desktop Bus (ADB) connectors in the rear of the machine. The mouse is then plugged into the spare ADP connector on the keyboard itself (you can plug it in the other rear ADB connector if you really want to).

The screen brightness control remains in the old position to the left under the display screen.

On the back of the casing, the connectors are arranged in the usual fashion in a row across the bottom edge. From left to right they include: two Apple Desktop Bus connectors; DB-19 floppy drive connector; a DB-25 SCSI port; two 8-pin serial ports and an external sound jack. The power-in socket is placed above the sound jack.

This all seems familiar, but above all these connectors is a new feature — a cut-out in the casing to allow internal expansion card cables to reach the outside world! When the cut-out is not being used, it is closed off by means of a push-in plastic blank. When card cables need to come through, they will most likely terminate at some sort of specially designed connector that holds fast in the cut-out.

Despite being an 'almost-open' system, the Mac SE can only be officially opened (that is, the screws can be removed) by an Apple dealer otherwise you will void your warranty. This could be a problem for you if the best deal on a multi-function card is to get it by mail-order — paying a dealer to have it

by the Mac II are based on the NuBus standard, a bus architecture optimised for 32-bit data transfers. Engineers I spoke to both inside Apple and at third-party developer sites had good things to say about NuBus. Typically, they referred to the 'power' and 'flexibility' of the system.

In terms of power, the NuBus architecture supports full 32-bit addressing providing for an ultimate total of 4Gigabytes of addressable memory. Three data sizes — 8-bit (byte), 16-bit (half-word) and full 32-bit (word) — may be transmitted synchronously at speeds of up to 10Mhz.

In the Mac II you can certainly have 8Mbytes of RAM on the motherboard and theoretically support another 2Gygabytes or so via the NuBus slots.

While the hardware specifications look good, there are two current software limitations with regard to NuBus resident memory on the Mac II. One limitation is that applications developed for the 68000-based Macintosh systems perform 24-bit addressing, and so 24-bit to 32-bit conversions have to be carried out by the 32-bit Mac II. Apparently, one implication of this is that you will only be able to access a maximum of maybe 1Mbyte of memory per slot while running software that uses 24-bit addressing.

The other problem is that since Mac software has always been designed to expect contiguous memory spaces (there has never been anything else!), when it comes to using NuBus resident RAM memory there will be maybe a 40 per cent to 50 per cent degradation in access speeds. Given the overall power of the 68020 it remains to be seen whether this is a significant problem or not.

In terms of flexibility, NuBus is intended to remain independent of any specific system architecture; can sup-

installed could well wipe out any savings you manage to make on the card purchase. This does seem to be a potential area for unnecessary frustration, but given what's happened with other Macintosh models I'm sure that users will find a way around the situation.

Once you've popped the top off the SE, you can see that the motherboard has undergone quite a dramatic change. It is still located at the bottom of the machine but the chip count is markedly different. The reason for this is that Apple has put the circuitry of about 19 previously independent chips onto a single gate array unit (see the photo). This ensures that there is enough extra space on the board to include the single 96-pin expansion connector. Expansion cards will themselves have to pack all their features onto a 10cm x 20cm area to fit flat on the motherboard (see the main Benchtest about cards announced by AST research).

The SE comes with 1Mbyte of RAM as standard; and this can be expanded up to 4Mbytes. RAM is in the form of surface-mounted256kbit RAM modules supplied as standard. 1Mbit modules will be used for upgrades. A new 256k ROM chip has also been included, although the ROM code is said to be only just a little over 128k in size.

I mentioned above that the Mac SE is supposed to operate about 15-20 per cent faster than a Mac Plus. One way that the Apple designers achieved the increased performance was by changing the way in which the CPU handled data processing versus video display tasks.

Whereas the 68000 spent an almost even amount of time taking care of data and video processing tasks on the Mac 512k and Mac Plus, the processing cycles on the Mac SE's 68000 are split differently: there are three for the CPU, and then two for the video, three for the CPU, and so on.

It may seem a small change, but the performance increase (plus other go-faster tricks such as putting some o/s instructions into firmware and using data cacheing techniques) means that you can recalculate large spreadsheets about 20 per cent faster.By providing the option of a hard disk and packing so much hardware inside the Mac case, Apple was forced to finally give in and install a small electric fan in the SE. It is of a 'squirrel cage' design and is quiet in operation. Also, the system clock is now powered by an onboard 7-year lithium battery.

System software

The Mac SE will run virtually all existing software, according to Apple. I wasn't able to contradict this statement with the range of standard applications that I used for testing.

Price

The Macintosh SE sells for $5320 without a hard disk and $6905 with a 20Mbytes hard disk. The monochrome monitor costs $772 and the standard keyboard costs $240 while the enhanced keyboard sells for $440.

Conclusion

The Macintosh Plus was the first of the Macintosh family of computers that business people didn't feel too embarrassed to work with; the Mac SE should remove any lingering doubts in their minds. It demands attention as a powerful business computer that stacks up well against other PC competitors.

Benchmarks

Note: These tests were carried out using compiled Microsoft Basic files (Microsoft Basic Compiler for the Macintosh)

Intmath	1.04 seconds
Realmath	0.60 seconds
Triglog	6.4 seconds
Textscrn	1 minute 40 seconds
Grafscrn	16.8 seconds
Store	4.8 seconds on SE 20Mbyte hard disk; 6.4 seconds on floppy

For a full explanation of the APC Benchmarks, see the November 1986 issue.

Technical specifications: Mac SE

Processor:	Motorola 68000 running at 8MHz
RAM:	1Mbyte standard. Expandable up to 4Mbytes
Expansion:	One expansion slot on motherboard
ROM:	256k
Mass storage:	Two 800k, 3.5in floppy drives or one 800k and an internal 20Mbyte SCSI hard disk
Display:	Standard Macintosh 512 x 342 pixel screen
Keyboards:	Can use any Apple Desktop Bus compatible keyboard, including IIGS model
Standard interfaces:	Two ADB connectors; two serial ports; one SCSI hard disk interface; sound jack
Operating system:	Apple Macintosh

port multiple processors; and overcomes the need to set internal configuration switches or jumpers by requiring ID ROMs on each NuBus card. The ID ROM not only tells the Mac II where a particular card is installed (a geographic location), but it also informs the system as to the card's capabilities. Each time the Mac II is switched on, the operating system checks each available ROM and then ensures that the card is properly initialised and that any required drivers are installed.

Fig 1 shows how standard NuBus address space may be located. The upper 256k of the total 4Gigabyte NuBus address space is reserved for what is called 'slot space'. This 256k is then sectioned into 16 areas of 16Mbytes each that correspond to the sixteen possible NuBus card slots or ID codes. The remaining address space is pretty much left up for grabs by the system and/or attached NuBus devices.

NuBus-style cards intended for use in the Mac II are of a similar size to the type of full-size card you would install in an IBM PC. They feature 96-pin edge connectors and a single hexagonal head screw is used to fasten the board into place inside the Mac II.

One company that announced new hardware for the Mac II and Mac SE in time to be included in this review was AST Research of Irvine, California.

The Mac II products are exciting in that they form part of the solution to running PC and Unix software on the Apple system. AST will be selling two co-processor boards — one with an Intel 8086 and another with an Intel 80287. Combine this with an external 5 1/4in PC-style disk drive (to be manufactured by Apple) and the right kind of software (reportedly being developed by Phoenix Technologies in the US), and you should be able to run all major IBM software packages on the Mac II.

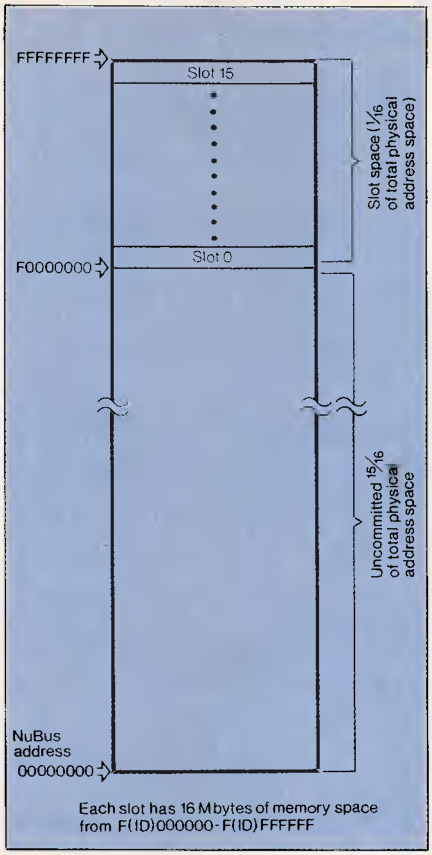


Fig 1 NuBus address space

A 4Mbyte memory card, called the AST-RM4, was also announced.

The two SE products described were grouped under the product family name 'MacPak'. They include: a multifunction card that features a 68020 chip with 68881 co-processor and 1Mbyte of RAM, and the AST-ICP intelligent communication processor card which features a 68000 CPU, 512k of RAM and four serial ports.

The ICP card will support AppleTalk, AppleToken, X.25 and SNA communications protocols, according to AST.

Many users may want to use the 12in monochrome monitor first since this is what the Mac II supports as standard. The standard video card (with a one to four bits per pixel range and 256k RAM onboard) provides the ability to display up to 16 shades of grey on the mono monitor. By upgrading the video card to 512k of frame buffer RAM, you can then have up to eight bits per pixel which translates into support for 256 colours or shades of grey from a look-up table of 16.8 million colours.

The Mac II colour monitor is a 13in Trinitron unit with some unusual features. Firstly, its vertical refresh rate (number of scans per second) is set at 66.7Hz instead of the more typical 60Hz. Secondly, the red/green/blue screen mask has apertures of only 0.026mm in diameter compared with the more typical 0.031mm.

The net effect of these two features is that the monitor is capable of producing very high quality 640 pixel x 480 pixel colour or monochrome images (compared with 512 x 342 pixels on the standard Mac Plus screen).

The colour, for a colour monitor, is great; the black and white, for a colour monitor, is excellent. The only difference you'll notice is that while displaying monochrome images the desktop grey pattern is slightly paler than it appears on the standard 9in Mac screen.

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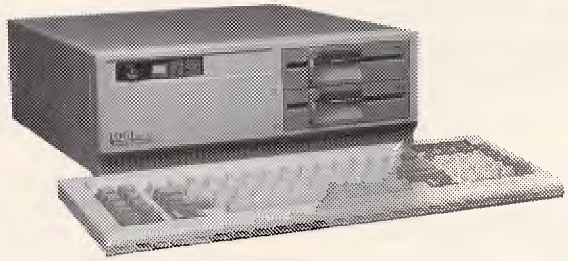

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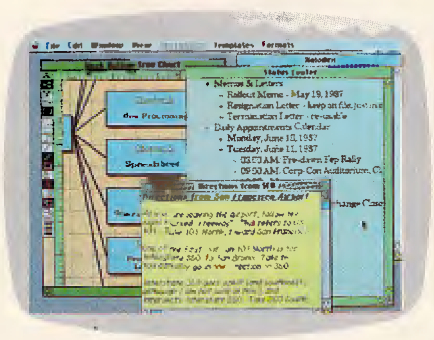
Except for an early prototype which got a bad case of the jitters and had to be left to cool down for a while, the Mac II colour monitor produced a rock steady image that was free of any undesirable colour hue.

At first it's a very odd feeling seeing the Macintosh interface and all your favourite applications up on these relatively large screens. Having been constrained within the boundaries of a 9in screen for so long, it's easy to move the cursor around a little wildly at first — but you soon get the hang of it. As with prior Macs, the Mac II control panel allows you to ratio cursor movement if you need to slow things down a bit.

Two new keyboards have been announced by Apple that can work with the Mac II, the Mac SE, or the IIGS for that matter.

The first, code named the Eastwood, is an 81-key model that features a 10-key numeric pad on the right-hand side. It has two Apple Desktop Bus connectors, one at either end: one is used for connecting the keyboard itself to the system unit; the other is used to attach the mouse to the keyboard. A large switch key is placed along the top left of the keyboard and this is used as a convenient system on/off switch, although both the new machines have separate power switches on their real panels.



Available for the Mac is Colour More from Living Videotext. Colour More is unusual in that it not only provides colour options for what appears inside the Macintosh windows, but you can actually select colour for the window frame itself

The Eastwood is virtually the same and has the same functions as the Apple IIGS keyboard.

The second keyboard, code named the Saratoga, is a much larger keyboard in that it has 105 keys including: a group of four cursor control keys arranged in an upside-down 'T' pattern; a 10-key numeric pad; and, most significantly, 15 function keys.

The main idea behind including the function keys is that this makes it really easy for users to work with IBM-style applications on the Mac II when they are supported by co-processor boards sporting Intel 8086 and 80287 chips. Unlike the PC keyboard, the Saratoga's function keys are set in a line above the main alphanumeric keys and are grouped into three sets of four and one set of three keys.

I had the opportunity to use both keyboards and felt that they were just fine. However, I'm not sure that I like the way that the mouse is connected to one edge of the keyboard instead of directly into the system unit. This arrangement does tend to result in a little more cable 'snaking' around the desk than you might like.

The low-profile mouse supplied with the Mac II and the Mac SE uses a mechanical tracking/optional shaft encoding mechanism to communciate x/y coordinate data to the system unit. A single button is provided for selection purposes.

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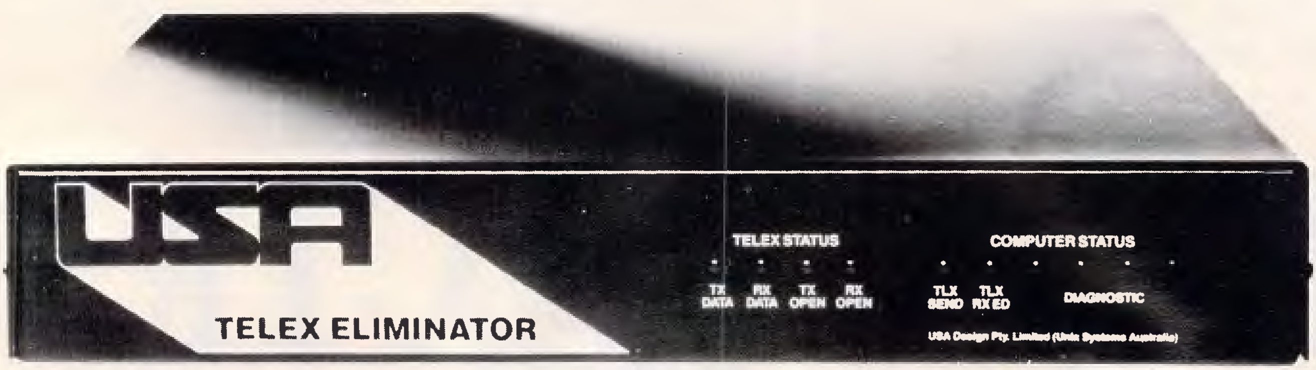

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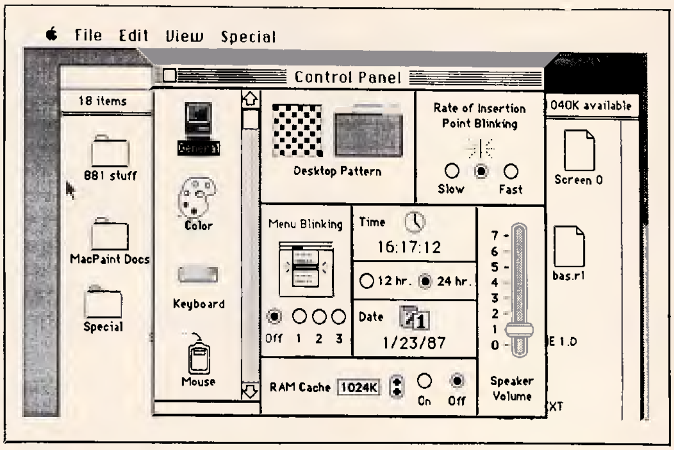

Fig 2 The general-purpose Control Panel allows you to set various options as before, but a new feature is the scrollable window which displays selectable icons

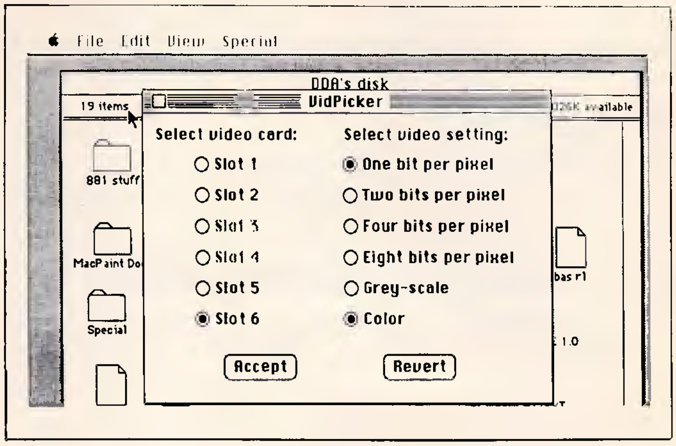

Fig 3 The VidPicker desk accessory sets the pixel depth. This determines in turn how many colours you get on the screen

System software

At the time of writing the new System and Finder files have not been finalised and so it is not clear what features the release versions will actually have. Certainly, the new environment will definitely not feature any multi-tasking capabilities as some people had hoped. In the near term it seems much more likely that Apple will instead take many of the features of the Switcher application and fold them into the Finder to provide multi-application work environments.

Those users who want multi-tasking right now will have to buy the optional Motorola 68851 memory management unit (PMMU) to run Unix System 5, version 2 that is to be made available.

Multi-tasking aside, there are a number of added system features that can still be usefully mentioned here.

To begin with, the Finder interface will retain almost all of its monochrome characteristics — in keeping with Apple's exhortations to third-party developers about using colour features sparingly and appropriately. The main way to tell when you are in colour display mode is by looking at the Apple menu at the top left of the screen — in colour mode the small Apple image appears in full rainbow colours, just like the company's logo. Also, whenever colour images are displayed, the mouse cursor is given the same rainbow colours so that it can be clearly seen — no matter what the background colour.

Note: On a Mac II provided for this review, there was one feature that didn't seem to be on the other machines I used. When I copied files from a floppy disk I noticed that the name of the duplicate file in the destination window/folder was displayed on a light yellow background until that file was itself selected with the mouse. Everything else remained monochrome. There was no confirmation as to whether this feature would appear in the final version of the Finder.

A further feature now added to the 'Options' menu is Restart which relaunches the Finder. Shut Down now performs a software power off on the Mac II — the switch at the back is in fact only a power 'on' switch.

A major development, although it seems subtle at first, is the restyled Control Panel. Whereas the first Control Panel was essentially a Macintosh version of the old Lisa 'Preferences' feature, the new Control Panel has been turned into a general- purpose application. In addition to being able to set general options (the mouse characteristics, the RAM cache size, the

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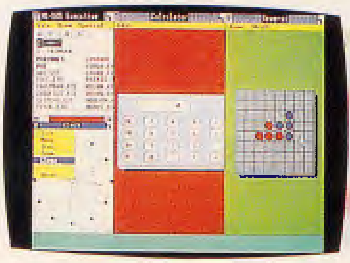
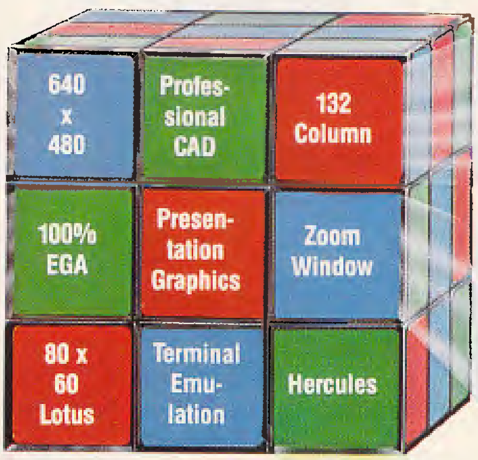
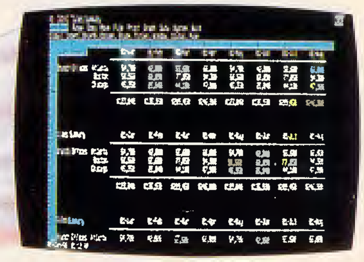


1. MS Window 640 × 480





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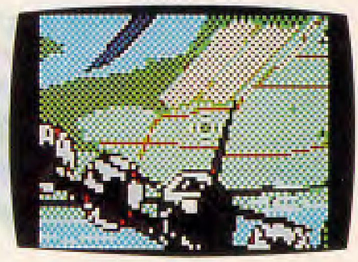

5. Dr. Halo Zoom Window in EGA or "480" Mode

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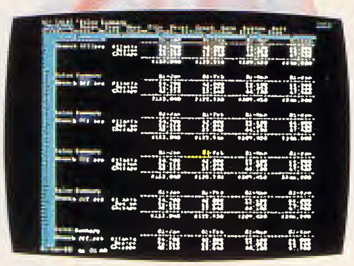
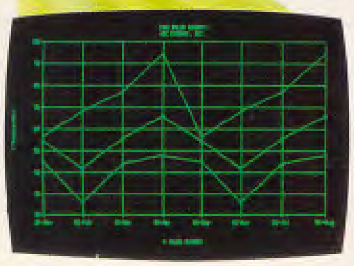


3. 80 × 60 Lotus Spreadsheet in "480" Mode



6. Hercules Compatible

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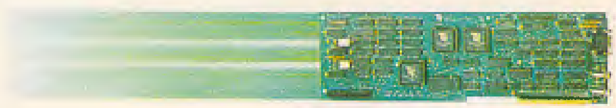

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speaker volume, or the background desktop pattern, and so on), the new version (see Fig 2) has a scrollable window on the left-hand side that will display a variable number of selectable icons.

As each different icon is selected, the window to the right is updated with new features or some special configuration program is launched.

An example of the latter is an RGB gun-focusing program which displays a full-screen cross ('+') and allows the user to adjust the colour focus control until the separate red/green/blue gun scans combine into single white horizontal and vertical lines.

Control Panel options will apparently be installable in much the same way that you might install a laser printer driver or any other device driver on current Macs. Third parties are said to be developing drivers even as I write.

One desk accessory available under the review machine's Apple menu was called the VidPicker, although I believe it will be called the Monitor's and colour palette panel. Choosing this option displayed the dialog box shown in Fig 3.

The idea behind the VidPicker is that it allows you to pick the monitor mode — black and white versus colour — and the number of bits per pixel that video cards installed in the Mac II might support.

Note that the titles for slots 4 and 5 are greyed, indicating that there are no video cards installed in either position. The VidPicker 'knows' which card is installed where via the ID ROMS that reside on each NuBus add-on card that is installed. This approach overcomes the need to set DIP switches every time a card is installed or swapped for a different one. To actually use the VidPicker all you do is select the monitor mode you wish to use and then click on the 'Accept' button — this sends a redraw command to the relevant video card and the screen image is redisplayed in the correct manner.

An interesting note related to the various bit levels used in producing images is that, in the future, applications developed specifically for the Mac II will be able to switch these levels intelligently as the situation requires.

Apple's handling of screen colours is particularly clever. From the control panel, and also under software control, it is possible to assign between one and eight bits to each screen pixel. This means that accessing extra colours gobbles up memory but keeps the screen resolution the same — 640 x 480. Assigning the maximum of eight bits per pixel allows the selection of up to 256 colours out of a palette of 16.8 million.

Since it requires a lot more work to scroll a full-colour image than it does a black and white one, colour graphics programs (for example) might support a full eight bits per pixel for displaying images but automatically switch to lower bits levels when the user wants to scroll the screen. I checked this out manually on the test machine to see how much of a difference this would really make and, believe me, it was dramatic.

There are two 'cute' changes that the Apple software developers intend to include in the new Finder. One is a trash can icon which expands in size (it bulges, actually) as unwanted items are dropped into it, and which then sinks back to its original form when the 'Empty Trash' option is selected. The other is a wristwatch icon that has revolving minute and second hands. This particular feature is not original though — there has been a file called 'Macwait.Init' available for some time via bulletin boards in the US that does the same thing on standard Macs.

Applications software

Apple claims that both the Mac II and the Mac SE are highly compatible with existing Macintosh software. To test this I tried out some of the popular applications. Most of them ran just fine with the notable exception of Flight Simulator which features some rather naughty and non-Mac standard programming tricks.

And that seems to be the main dividing line between software that will work and that which will produce a system crash. If an application goes looking for a specific device at a specific system address it may not find it and, therefore, cause a system crash. If it uses the correct system calls everything should be OK.

Many public domain programs constantly live on the edge of extinction since they don't necessarily conform to Apple's Macintosh software design guidelines, so I tried out a few of them as well. Interestingly, most of them loaded just fine. The major problem was that the programs assumed that they were working on a 9in screen and would, therefore, not use all available space on the larger 12in and 13in Mac II monitors. Alternatively, the programs would assume an incorrect starting point and so place most of an image off the screen or wrap it around in some bizarre manner.

Obviously, for some, the most important feature of software for the Mac II will be whether or not it supports the features of colour QuickDraw code in the new 256k ROM.

Although not everybody is aware of it, QuickDraw, the Macintosh graphics package, has always been able to support colour to some degree. Until the Mac II the only way to see this was when you used some program that used QuickDraw's colour abilities to

Technical specifications: Mac II

Processor:	Motorola 68020 running at 15.6MHz
Co-processor:	Motorola 68881 floating-point device
RAM:	1Mbyte standard expandable up to 8Mbytes on-board and 2Gigabytes via NuBus add-on slots
Memory management:	Optional Motorola 68851 memory management unit, available for running Unix on Mac II
ROM:	256k
Mass storage:	Up to two 800k 3.5in floppy disk drives plus a 20, 40 or 80Mbyte SCSI hard disk installed internally or externally
Displays:	12in monochrome monitor providing 640 x 480 pixel resolution. 13in colour monitor providing 640 x 480 pixel resolution
Video card:	Apple custom video card featuring 256k RAM as standard that provides support for up to 16 shades of grey. Upgraded video card with 512k of RAM provides support for up to 256 individual colours from a look-up table of 16.8 million colours
Keyboard:	Any Apple Desktop Bus compatible keyboard
Standard interfaces:	Two 8-pin serial ports; one DB-25 SCSI port; two Apple Desktop Bus connectors
Expansion slots:	Six NuBus standard card slots
Sound:	Apple Sound Chip providing 4-voice, single channel output or capable of driving external stereo equipment
Power:	Self-configuring power supply capable of handling voltages between 90 to 270 volts AC and input frequencies of between 48 to 62Hz
Operating system:	Apple Macintosh

send output to colour hard copy devices such as plotters; Cricket Graph is just one example.

Developers could also use Macintosh Pascal to write programs that called QuickDraw's colour routines directly even though colours other than white appeared as black on the monochrome screen. The Pascal constants used for this purpose are: blackColor; whiteColor; redColor; greenColor; blueColor; cyanColor; magentaColor; and yellowColor.

While reviewing the Mac II, I made the discovery that Microsoft Basic for the Macintosh already supports colour even though this feature is not openly documented.

To draw a black rectangle with MS-Basic you could use the following LINE statement:

```
LINE(10,10)-(100,50),33,bf
```

where the number 33 is the accepted value for black and white and the 'bf' indicates that Basic should draw a box at the given coordinates and fill it with the specified colour. If the number 30 were used instead of 33, the rectangle would be filled with white: that is, it would appear as an empty outline on the mono screen.

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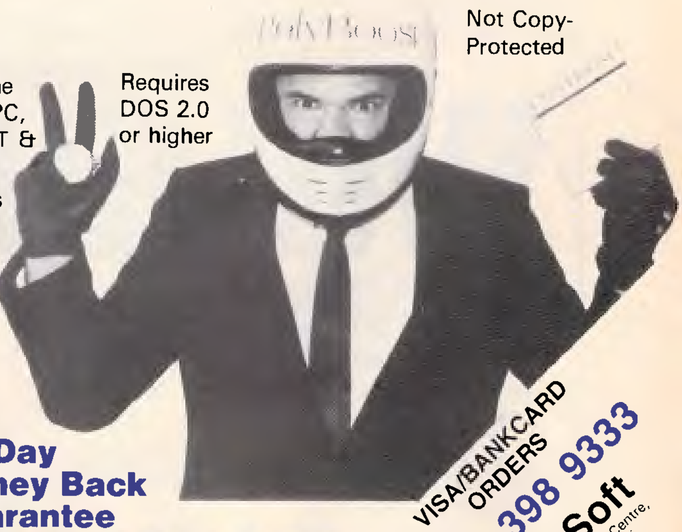

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Benchmarks

These timings were obtained using compiled Microsoft Basic files.
Please note that because of the extra work involved in 'bit-blitting' images on the larger Mac II screen (12in mono or 13in colour), the time for the Textscrn Benchmark does not fully represent the speed difference between the Mac II and the Mac SE.

Intmath	0.26 seconds
Realmath	0.16 seconds
Triglog	1.68 seconds
Textscrn	2 minutes 6 seconds (full Mac II 13in screen)
Grafscrn	8.0 seconds
Store	2.36 seconds on 20Mbyte hard disk 5.2 on 800k floppy disk

For a full explanation of the APC Benchmarks, see the November 1986 issue.

Price

The Mac II without monitor and hard disk costs $7693. The Mac II with a 20Mbytes hard disk costs $10,980. The RGB monitor costs $1911 and the video card $972. Keyboards cost $240 for the standard model and $440 for the enhanced model. The expansion kit will cost $279.

Documentation

No documentation was available for the review.

Conclusion

The excitement that surrounds the Mac II does not necessarily come from any single technological breakthrough. Certainly the use of the powerful 68020 chip and its 68881 co-processor places it firmly in the 'advanced machine' league. Certainly the colour capabilities of the system are excellent. It's nice to have six expansion slots as well. But many machines already boast powerful CPUs, expandability, and colour.

The really important thing about the Mac II is that it marks Apple's entry into the realm of serious computing. All of the machine's components are married together in such a smooth manner that the Macintosh user interface, with its icons and select-and-go approach, becomes a tremendously efficient working environment instead of just a nice 'user-friendly' piece of code. You can disagree with any number of individual design details on the Mac II, but you can't call it a toy.

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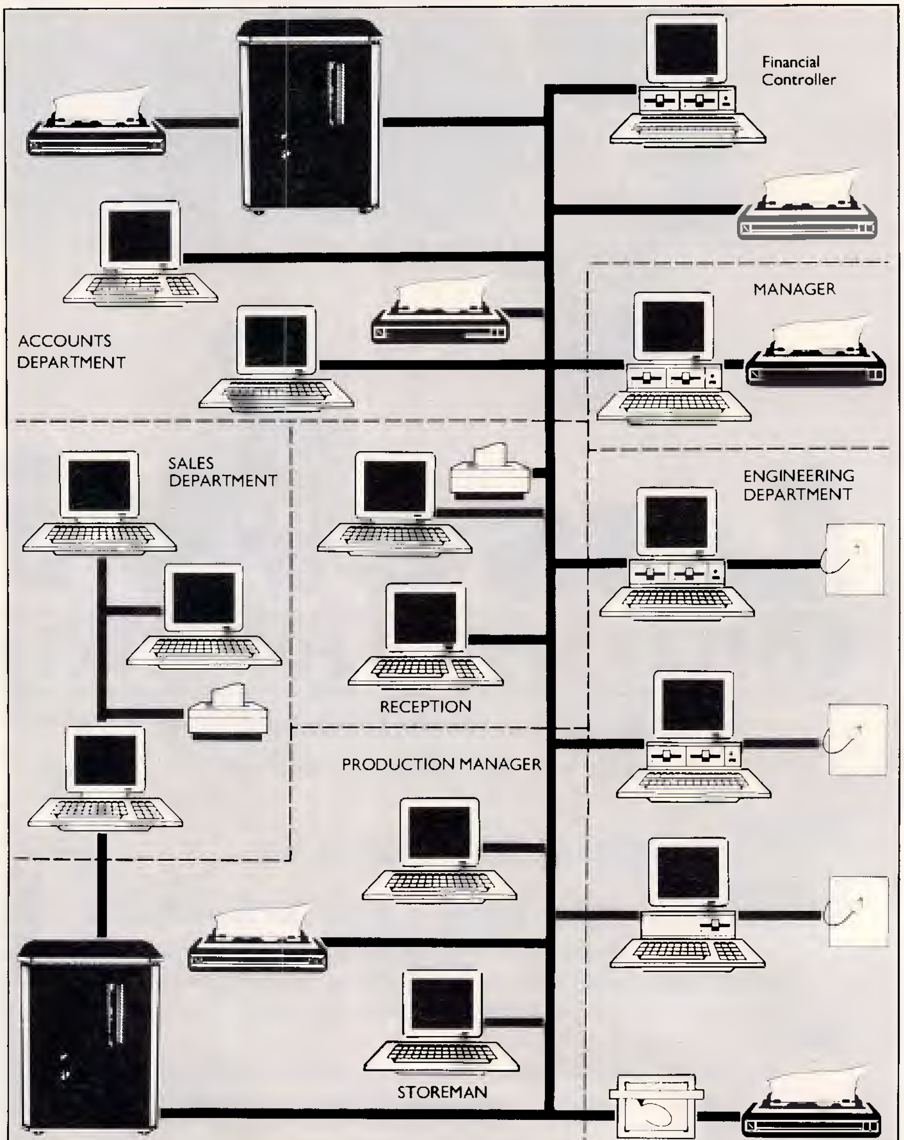

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2 Everyone has up-to-date information, updated immediately.

3 Lynx runs all existing PC software and more. Universe extends to run the massive library of CP/M (8 bit), CP/M-86 (16 bit), MP/M (multiuser) and Concurrent DOS software. Don't get trapped with unsuitable single user software – as you could with other networks.

4 Lynx provides full multiuser security. Password protection of information and software makes Lynx a safe network.

5 Lynx is simple to use and learn. We've engineered it to work in a normal office environment. And with Lynx, your training and support come from AED, the company that configured the network – and that's a service unique in Australia.

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PCNX

PCNX conveys the great advantage of Unix — multi-tasking — to the IBM PC and AT. But, considering its lack of programming tools, where can PCNX best be utilised? Alan Solomon tries to discover its ideal niche.

Unix is an operating system, just as DOS is. But Unix has a very different feel to it — for example, Unix is designed to be multi-tasking and multi-user, so one person can make the computer do several things at once. It also means that several people can use the same computer at the same time, without causing each other problems when for example, they both access the same file.

Multi-tasking is already possible to a limited extent in DOS. The DOS Print command lets a user get on with his work while the slow printer chugs away in the background. Unix generalises this facility, and lets you run *any* task in the background. If you are developing software, you might want a big module to compile; but while it is compiling, you can get on with writing the documentation.

Multi-user operation is not normally possible in DOS. With a multi-user system, several people can be logged on at once, and may even be accessing the same database. The most popular use of this is for accounting systems, where there might be several people putting information into the accounts (bought ledger, sales ledger) and others taking information out (for example, in response to customer enquiries about stock levels). The only way around this in DOS is to have several micros linked together in a network, using software that supports multi-user access.

But with Unix, it's possible to have several people using the same IBM PC or AT at once. Unfortunately, most implementations of Unix are very expensive, and there isn't as much business software for it as there is for DOS. But Unix is very popular in educational establishments, and it is considered by many programmers to be the ideal program development environment.

Installation

Knowing Unix's need for a large hard disk and lots of CPU power, I installed it on an AT clone, running an 8MHz 80286 chip. I really needed that extra speed, as even on this fast machine PCNX ran very slowly.

The installation was unnecessarily lengthy. I had to create a large number of sub-directories and sub-sub-directories, and copy the appropriate files into each one — it's hard to see why Wendin, the author, doesn't provide a simple batch file to do this job. The software comes on four disks, which is a lot of software, but Unix normally comes on a dozen disks.

Wendin has saved a lot of effort by running PCNX under DOS, as it means that the company doesn't have to write all the file-handling that would otherwise be needed. Also, there is no compiler or text-formatting software with the package, but these are not necessities and you can probably use your existing compilers.

In use

PCNX runs under DOS. You start up DOS in the usual way, then type PCUNIX, which starts up PCNX. PCNX asks for your log-in name and password; displays 'Welcome to Wendin multiuser PCUNIX 1.03'; and gives the date and time and then the prompt, which is # for the super-user and $ for everyone else. The super-user is the user with power over the system: he or she can create and delete user-names, and has the responsibility for looking after the system. Ordinary users have much less power, to prevent them from accidentally damaging each other's files.

With DOS, you can simply switch off when you've finished. This is not recommended when there are other users on the system, as is liable to be the case in Unix. To get out of PCNX, you type Ctrl-Z at the '$' prompt and you are logged off. To shut down the system completely, you log-in under the user name 'shutdown'.

PCNX isn't just a simulation of Unix. It would be relatively easy to write a DOS shell that accepts Unix commands and translates them into the equivalent DOS commands, and you could write DOS utilities to do the things that the Unix utilities do. But if you did this, you would not be able to have multiple tasks and multiple users. PCNX does allow other users to be connected at the same time; there can be one person on the main console (the normal PC keyboard and screen), and one or two other users connected via the serial ports. As some software writes directly to the screen, the two users connected on the serial port will not have access to that so there's a limitation on what they can do.

Unix is multi-tasking: you can make something that is time-consuming operate as a background task while you get on with something else in the foreground. If your compiler is invoked by the command 'cc myprog', then you

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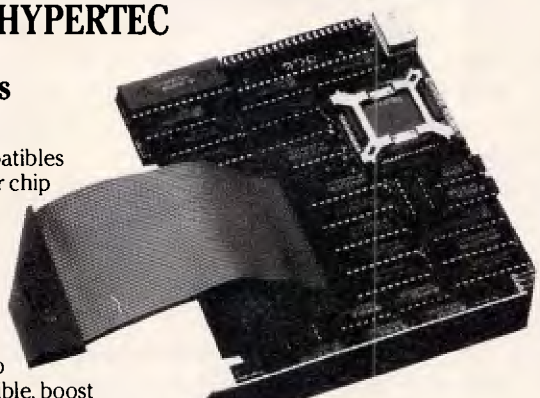

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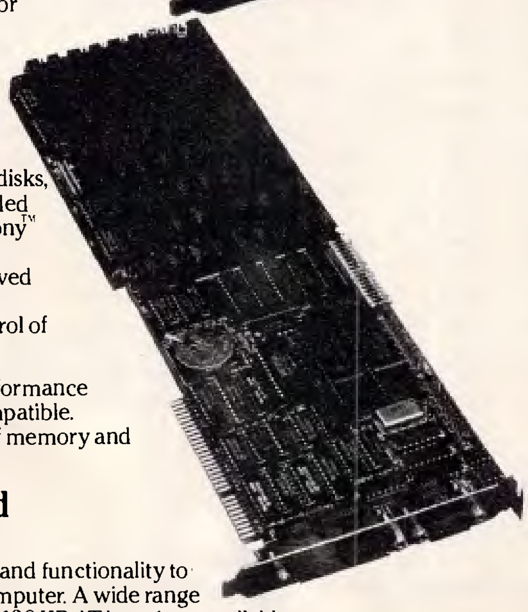

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Freelance	$485	$549
Freelance +	$619	$729
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Sidekick (Unprotected)	$99	$118
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Some shell script commands

shift:	like the MS-DOS SHIFT
if:	conditional execution of commands
case:	choose one of the cases below
while:	loop while a condition is true
until:	repeat until a condition is false
for:	like the MS-DOS FOR
break:	premature exit from loop
continue:	do the next loop iteration

can avoid a long wait by typing 'cc myprog &'. The compilation will then work away while you get on with something else. You can see how the compilation is progressing by typing 'ps' (process status) at the $ prompt.

You can have .BAT files in DOS, and there is even a primitive kind of loop command — the FOR statement. PCNX allows much more elaborate .BAT commands called shell scripts. The shell is the name given to the thing that reads keyboard input and processes it; it is equivalent to COMMAND.COM in DOS. A shell script can contain any legal Unix command (just like a DOS .BAT file), and also allows variables like the DOS %1, %2, and so on. Variables can be defined at the $ prompt, and there are some very powerful looping commands: you can use 'while', 'until', 'case' and, of course, 'for'. You can prompt the user for input and take different actions depending on what he types. There is also an 'if' . . . 'then' . . . 'else' construction, and all of this makes it possible to construct shell scripts that are much more powerful than DOS .BAT files.

Capabilities

PCNX works — in a sense. You can log on as 'root', and create other users. Other users can log on, either on the main console or over the serial ports, and during this review I tried having two users logged on at once. It all worked: the user called 'root' could kill the other user, and both users could send each other mail, and could run processes.

Up to three users can log on at once, one of which is on the console and two are connected via the serial ports. But the manual warns that PC or XT systems might not be able to cope with having the two extra users logged on at 9600 baud, and PCNX is liable to crash — although AT systems should cope.

There is also very little protection of memory areas between users because this is impossible to implement on an 8086 machine, so production and development should be done on two different systems. You can't run Basic or BasicA programs because both of these take over all the interrupts for their own use, which would lock out the two remote users.

But in two other senses, PC-Unix *doesn't* work. Most of the DOS programs I tried crashed the system. It seems that any program which uses the 'traditional' file-handling DOS function calls doesn't work, and makes the system hang. Unfortunately, this problem applies to most programs as there is no good reason for a programmer to avoid using these functions,

List of supported commands

at:	execute command at a later time	**newgrp:**	change active group name
atrun:	background job spooler	**news:**	display system news
cat:	like DOS type, but more general	**nice:**	run command at low priority
cd:	change directory	**nohup:**	run command at low priority, with output redirection
cmp:	compare two files	**od:**	octal dump
cp:	copy files	**passwd:**	change password
date:	set system date and time	**pr:**	format document with headers and footers
df:	show disk free space	**ps:**	show process status
dstat:	show status of devices	**pwd:**	show current directory
echo:	like DOS	**rev:**	reverse characters in each line of a file
exefix:	adjust the space that a program demands	**rm:**	delete file
false:	returns 'false'	**rmdir:**	delete sub-directory
file:	guess file type	**rmgroup:**	delete group
find:	find files	**rmuser:**	delete user from system
finger:	get information about other users	**sh:**	the shell
grep:	find a pattern in files	**sleep:**	sleep for n seconds
group:	discover which group you are in	**strings:**	display ASCII strings in executable file
grppswd:	change group password	**su:**	substitute user-name
head:	display first part of file	**tail:**	display end of file
kill:	terminate process	**tee:**	create a tee in a pipe
line:	copy one line from input to output	**test:**	test an expression
logname:	display log-in name	**time:**	stopwatch
lpd:	controls the background printer	**touch:**	set the date and time on a file to now
lpr:	like DOS PRINT	**true:**	true
ls:	like DOS DIR	**tty:**	show terminal ID
mail:	send and receive electronic mail	**uniq:**	report repeated lines in a file
mkdir:	like DOS MD	**wc:**	lines, words and characters count
mkgroup:	create new group	**who:**	who is on the system?
mkuser:	create new user	**whodo:**	who is on, and what are they doing?
more:	display in screenfuls, like DOS MORE	**write:**	put a message on someone's screen
mv:	rename files, or move between sub-directories		

and sometimes there are good reasons for preferring them. If you want to use PCNX for serious work, you'll have to write your own programs.

The second sense in which PCNX doesn't work is that it's slow. If you run a program or a DOS utility, it sometimes seems to take forever before PCNX starts to do anything useful. And with more than one person doing something, it seems as if much of PCNX's time is spent in thrashing the disk back and forth.

Applications software

There is very little applications software that runs under PCNX. In particular, dBaseIII won't work, nor will most word procesors, however, most compilers *will* work.

The main practical use of PCNX will be for people who want to write their own multi-user software, using C, Pascal or another language that PCNX supports. You should check before buying PCNX that it supports the language that you intended to write in. I tried the MS-DOS version of Turbo Pascal 3.01a and it worked fine when installed for a teletype terminal, but I couldn't edit.

Documentation

The manual is very large and quite complete. It presents the various Unix commands and utilities in the first part; and the second part covers the system calls, for people who want to write

```
login:alan
password:
Welcome to Wendin Multiuser PCUNIX 1.03 on 08-Nov-1986 02:14:08.61

$ ls                          {list the files}
makeunix.bat   bat.prf        bin          usr            etc
tmp            src
$ cd d:                       {go over to drive d}
$ ls
ls: command not found         {because it isn't on the default drive}
e:ls                          {list the files on drive d}
command.com    turbo          dev          light          123
comms          sk.com         sk.hlp
$ cd /turbo                   {go to the Turbo subdirectory}
$ e:ls
turbo.com      turbo.msg      lister.pas
$ turbo               {run Turbo}
-------------------------------------
TURBO Pascal system      Version 3.01A
                                MS-DOS

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-------------------------------------

Terminal: TTY


Include error messages (Y/N)?Y

Loading D:\TURBO\Turbo.MSGLogged drive: D

Active directory: \TTY

Work file:
Main file:

Edit    Compile  Run   Save

Dir     Quit compiler  Options

Text:     0 bytes
Free: 62224 bytes
```

```
>C                              {compile a program}

Work file name: lister

Loading D:\TTY\LISTER.PAS
Compiling
  210 lines

>

{we then compiled the program to disk; all that is omitted}
>Q
$ lister                        {we then ran the program}
Enter filename: lister.pas
Printing . . .
$ e:ls
turbo.com      turbo.msg       lister.pas      lister.com
$ e:cp lister.com 1.com         {showing how to copy}
$ e:ls
turbo.com      turbo.msg       lister.pas      lister.com      1.com
$ e:rm 1.com                    {and how to delete}
$ e:ls
turbo.com      turbo.msg       lister.pas      lister.com
$ cd e:
$ ps                            {process status}
PID TTY   STAT  TIME COMMAND
  2 tta0: W     0:40 -/bin/sh   {process number 2 on terminal tta0
                                 the process is Waiting, the time is
                                 0:40 and the current executing command
                                 is sh, the shell, in subdirectory /bin/}
$ ls c:\ssware > 1.1 &        {kick off a long directory listing, and
                              redirect the output to a file, and make it
                              run in the background}
$ ls                          {list the files while that is going on}
makeunix.bat   bat.prf        bin          usr            etc
tmp            src
$ ^Z                          {tell PCNX that we've finished}

login:shutdown                {shut down PCNX}
password:
E>                            {the DOS prompt}
```

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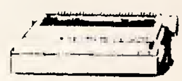

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software that will work under PCNX. These look very much like VAX system calls — in fact, it looks as if PCNX is just PC-VMS (the other operating system that Wendin sells) with a different front end.

Both systems have been built from Wendin's Operating System Toolbox, so it's easy to see why they have so much in common. It looks as if Wendin wrote PC-VMS first, then extended out from there.

Conclusion

So what is PCNX useful for? Not as a serious working tool, as there are too many DOS programs that it won't run. Perhaps as a system development tool; you could develop Unix systems on PCNX, then do some final polishing up on the target machine. But again, the lack of programming tools is a serious problem. Probably PC-Unix is most valuable as a way to learn Unix or to teach Unix to other people.

END

PCNX costs $US99 plus $20 handling and is available from Wendin Incorporated, Box 3888, Spokane, Washington 99220. Tel: (509) 624 8088.

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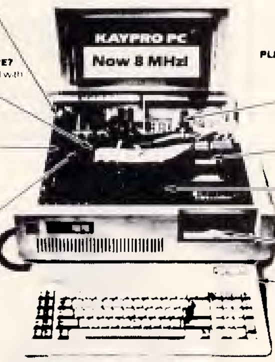

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As you like it

A page description language acts as the common interface between your chosen software and output device to allow the best possible definition of your printed page. But, unfortunately, there's no agreement yet on a common standard. Kathy and Terry Lang discuss such a language's merits and look at contenders for the 'crown'.

Anyone who has used a word processor will be familiar with the difference in appearance between screen display and printer output of the same information. This 'difference' will, to some extent, depend on the software and on how hard it wants to give you true WYSIWYG — What You See (on the screen) Is What You Get (on the printer). But at the present time no word processor, however hard-working, can achieve that task — if only because of the physical differences between screen and printer.

The only situation in which true WYSIWYG is achieved is when you do a screendump; then the pattern of dots on the screen is translated faithfully into a pattern of dots on the printer. And if you have a conventional microcomputer such as an IBM PC with CGA or EGA graphics, or a Macintosh, the result is the same inadequate resolution on the printer as is shown on the screen. With a screendump, you get one dot on the printer for every pixel on the screen; on the Macintosh, for example, the screen resolution is 72 pixels per inch, while a typical matrix printer can manage 240 dots per inch. Such a screendump, therefore, drives the printer at about a third of the resolution of which it is capable.

Drivers

To make better use of the capabilities of the printer, and provide other facilities at the same time, application programs such as word processors provide a sub-program called a driver which controls the printer by whatever means the manufacturer provides. Where matrix and daisy-wheel printers are concerned, this usually consists of a set of codes amounting to a very crude programming language.

Typically every instruction consists of a command character, usually ESCape, followed by codes peculiar to that printer. (For example, almost all matrix printers use the codes ESC 12 to issue a form-feed to advance the paper by one page). Such a set of codes allows the word processor, for example, to print text flushed to the left and right margins — justified — by adjusting the space between letters and between words in very small increments; even on a daisy-wheel they may be as small as 1/120th of an inch. On the screen, by contrast, text is normally shown monospaced; that is, every character always takes up the same amount of space, and justification is possible only by adding extra space between words. Even when using a word processor which operates in graphics mode, such as those used on the Mac, and Word on the IBM PC, the resolution of the screen does not make it possible to see exactly what effects will be created on the printer.

The major disadvantage of such crude devices for controlling the printer is that they are very specific to the printer concerned. Flexible word processors, aiming at a wide market typically have scores, and in some cases hundreds, of printer drivers included so that they can work with any printer on the market.

Another real drawback of driver devices is that they are very hard to

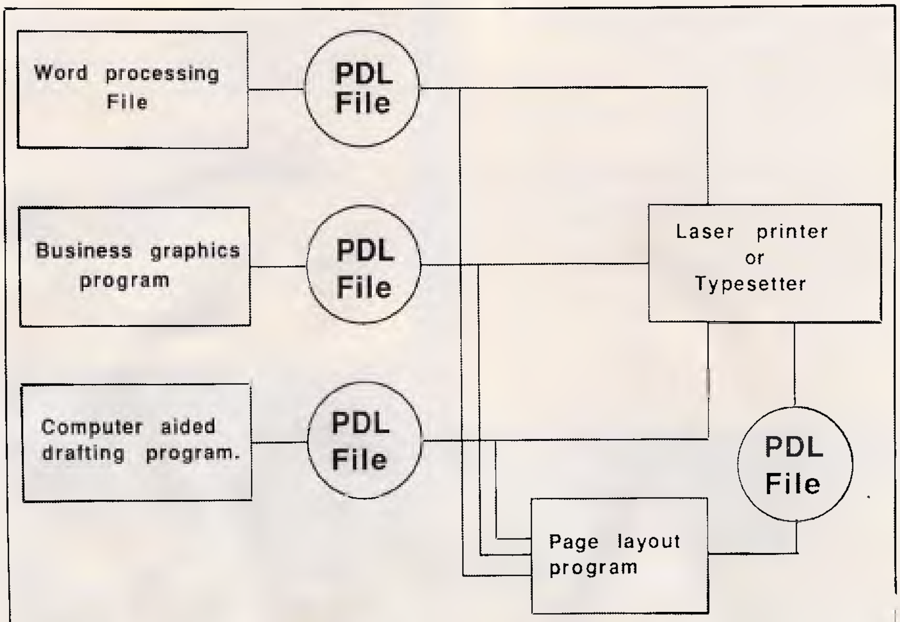

Fig 1 The page description language: interface between packages and printer

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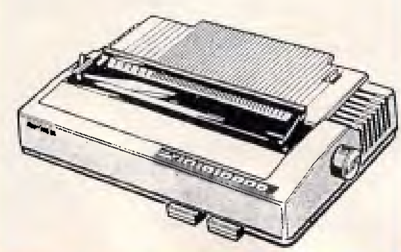

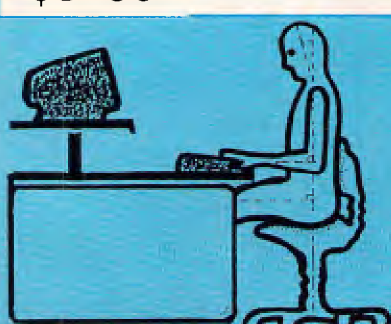

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work with; the situation is comparable with the early days of computing, when computers could only be programmed in their basic instruction sets, and common languages such as Basic were unknown.

Another disadvantage is that these languages are essentially line-orientated; that is, they describe each line of output, whether it be a set of characters in a text line or a set of individually-defined dots in bit-mapped graphics, one line at a time, rather than handling larger units. There are a number of advantages to being able to compose output a page at a time, rather than a line at a time, especially when mixing text and graphics, when it is necessary to use both characters generated as standard shapes, and graphics generated as bit-maps.

This development has been much advanced by the appearance of laser printers which work by setting up a page of text in the printer memory before outputting anything. Although they *can* work by emulating existing printing techniques based on line-orientated codes, to get the best out of laser printers page orientation is needed. This, together with the other disadvantages of crude line-orientated printing command languages, has led to the development of printer control languages based on the page, which are known as page description languages.

Page description languages

A page description language (PDL) is exactly what it states: a language which can be used to describe the layout of a complete printed page. The emphasis is on describing a *whole* page, rather than just a *single* character or *line*:

— because a set of pages may often have common features that repeat: for example, page headers and footers;

— because a single illustration may occupy a whole page; and

— because a laser printer sets up the image of a whole page in its internal memory before transferring it to paper.

A PDL aims to the *lingua franca* between software packages which generate text, drawings and pictures, and the printers on which you may wish to reproduce them. This situation is illustrated in Fig 1.

The other major advantage of a PDL is that the description of the ouput in more general terms makes it possible to use the same 'program' to send ouput to different devices, producing the output at whatever resolution each device can achieve. Thus the use of a PDL should allow you to print the same document on a matrix printer and on a laser printer, to the highest resolution possible on either printer, without changing the appearance of the document at all. There would be a lot to be said for a commonly recognised 'standard' PDL which will support our changing printing needs over a long period.

Page description languages are very attractive to software houses and printer manufacturers, since by working with a standard PDL manufacturers can fit their products into a supportive environment where they can be of immediate use. (Of course a very large supplier of printers and of software might prefer to avoid the competition by introducing a standard of its own, but more about that later. It is in any case hardly unknown for such a proprietary specification to become a *de facto* standard in its own right).

Almost by definition we are assuming that a standard must be a good thing. But as such it must first find common acceptance, and be robust in the face of technological change. The IBM PC is a classic example of a *de facto* standard which has been widely accepted (warts and all), whereas the graphics facilities on the IBM PC have not commanded wide support and this had led to fragmentation of the market, unsatisfactory products, and higher costs for end users. If a page description language is going to achieve success as a standard, it must have a number of important characteristics:

- It must work with a wide range of printers; for example, with laser printers working at 300 dots per inch and typesetters at over 1000 dots per inch.
- It must be able to support technical innovations as they arise; for example, colour printing, and simultaneous printing on both sides of the paper.
- It must be convenient for software packages to generate, with easy encoding of text, sketches and CAD drawings, and scanned pictures. The above-mentioned factors imply that the language should describe the page at a high conceptual level, avoiding the nitty-gritty detail that is more likely to get bound up with some particular technological feature. Committees around the world have spent years justifying their existence by considering standards for encoding graphics, and it is desirable that this work should be taken into account.
- It must be easy for any printer to interpret a page description, and to produce output matching that description as closely as the hardware facilities permit. Unfortunately, easy interpretation conflicts with the above requirements.
- The representation of any particular page should be as compact as possible, both to save space on your disk, and to minimise transmission time when you want to rush your manuscript over a network.
- The extra cost involved in providing the processing power which must be built into the printer, and in royalty payments to the definers of the PDL, should not be too high.

A 'high-level' PDL would, for example, define a page in terms of the page header and footer, and the sizes of the margins. A 'low-level' PDL might describe a page as little more than a series of small dots at different locations; in this case it would be hard, if not impossible, to realise that a particular dot was in fact part of a digit '2' in a Century Schoolbook font that was part of a page number which was in turn part of a regular page heading. It would conceivably be possible to have a page description language which described pages at both levels at once — an 'intelligent' printer would read the high-level description and use all the hardware facilities available to it to generate a high-quality picture, whereas a relatively 'dumb' printer could ignore the high-level description and just do its best with the low-level description, simply trying to put dots of about the right size in about the right places.

Parallel

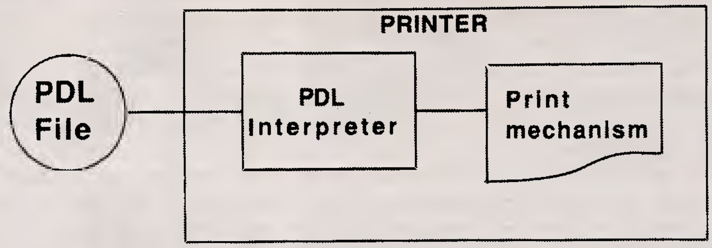
We have already drawn the parallel between translating one document description onto many printers and translating one computer program onto many computers. This can be illustrated by taking Fig 1 and replacing 'Page Description Language' with 'Programming Language', and the different types of printer with different types of computer. This parallel reinforces just how important the page description language is, and just how difficult it may be to arrive at a standard which is accepted.

Think of your latest Basic program; behind it you must have the computer processor and an interpreter before you can actually run the program. Similarly for your document

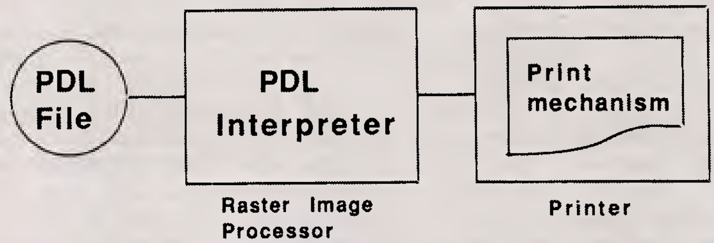
'programmed' in a page description language — this must be interpreted by a processor and interpreter built into the printer, as shown in Fig 2. As we have already indicated, we are looking for a compact 'high-level' PDL, and so it should come as no surprise if a powerful processor and lots of memory are needed to interpret it. Early implementations of the Postscript PDL (of which more below) used 68000 processors, and were still unable to drive a typesetter at full speed — though later models with a 68020 processor can now produce 20 to 40 pages per minute on a laser printer. Lots of memory is also needed: to represent an A4 page as a series of dots spaced at 300 per inch requires about 1Mbyte of store, while at a low-quality typesetter resolution of 650 dots per inch this becomes 5Mbytes.

Sometimes the processor and memory are not built into the printer, but are included in a separate box which stands alongside the printer and is interfaced with it — such a processor is called a Raster Image Processor (or RIP to the cognoscenti): this is a common arrangement with typesetters (as also shown in Fig 2). In theory there's no reason why a RIP shouldn't be equipped to interpret more than one page description language — but don't expect to get it for free.

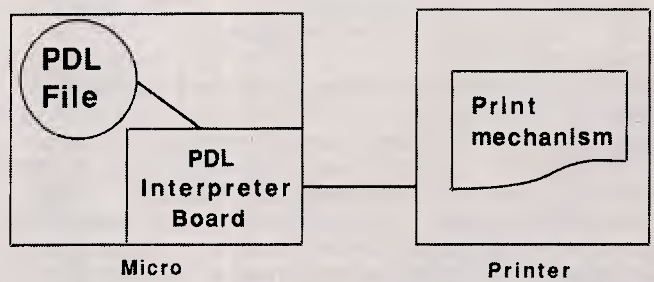
The RIP could be even further separated from the printer, and built into a board mounted in one of the spare slots in your PC. You could even use the ordinary processor and memory in your micro, running a PDL interpreter just as any other program, and driving the printer as any other peripheral. (But without a fast processor it might be unacceptably sluggish).



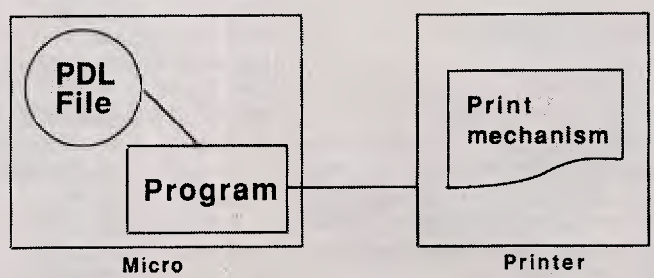
(a) Page description language processor/interpreter built into the printer



(b) Page description language processor/interpreter in separate RIP



(c) Page description language processor/interpreter on add-in board in micro



(d) Page description language processed by ordinary program in micro

Fig 2 Four approaches to printing from the page description language

In practice

Every printer has a specific set of hardware capabilities, and it is up to the person who implements the PDL interpreter in that printer to produce the most faithful representation of the document using those capabilities. This needs some judgement, however, and the results might not be exactly what you were expecting: for example, there may be a variety of ways in which halftone shades of grey may be generated or a specific printer may not implement all the typefaces you have called for, and you may then have to choose the font which best matches what you want or specify within the PDL a full specification of the new face.

Typically you may be generating your page description from a word processor. If the word processor seeks to cope with a wide range of printers, including simple impact printers without a PDL, then it will probably take over for itself all the calculations of justification and word spacing. Such calculations might use assumptions of individual character widths slightly different from those used in the printer; alternatively, they might assume that only inter-word and inter-letter spacing can be varied. The end result could fall somewhat short of what you would regard as the very best attainable on that printer.

Contenders

There are a number of page description languages being put forward as the desirable standard, the best known of which is Postscript. Postcript comes from Adobe Systems Incorporated, and traces its origins back to research work

in the Xerox Parc Research Centre at Palo Alto in the late 1970s — a most respectable pedigree. It is supported today by many packages and printers — for example, you can use Mircrosoft Word to prepare your text, with Postscript as the bridge for draft printing on the Apple Laserwriter and final printing on a Linotype typesetter.

Another candidate is DDL (short for 'Document Description Language') from Imagen: this is a development of the earlier imPRESS, and has just been adopted by Hewlett-Packard. H-P is reported to be bringing out a processor (a RIP) for DDL on a plug-in IBM PC board that will drive its Laserjet printer. It is also reported that the seminal PageMaker page-layout program will be extended to produce DDL (it already supports Postscript).

Meanwhile Xerox, having inspired Postscript though not brought it to the market-place, is rumoured to be gestating Interpress. Xerox has acquired the widely acclaimed Ventura desktop publishing package, and it could be that this will generate Impress (in addition to Postscript).

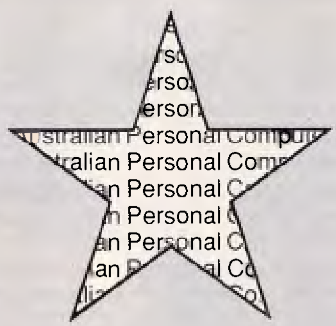
The dark horse in all this is IBM. At present, it is not at all clear whether it will enter this particular race, or whether it will confine its efforts to the upper end of the market, currently occupied by large workstation-based systems, often running under Unix, and with starting prices in the $60,000 upwards bracket.

What is needed is one or a very small number of standards; the questions are 'Which' and 'When'? As to when, standardisation too early could have long-term drawbacks as the technology develops; the ideal time would seem to be just before you buy your own desktop publishing package. As to which PDL, that remains to be seen; the result may well depend upon more than simple technical merit.

At present, Postscript has a head start, but even its best friends, unless they are totally committed to stack-orientated languages, do not regard it as being easy to write. The size of the manufacturers concerned must make it likely that Interpress and DDL will contest the market for a long time to come, and it may well be that these three will be supported by all the leading printer and software manufacturers — three is, after all, a small number compared with the number of different printers around.

Postscript in detail

Postscript is well-documented in two books, *The Postscript Language Tutorial and Cookbook,* and *The Postscript Language Reference Manual,* both of which are published by Addison Wesley. If you have programming experience, you should find them very readable. One of the nice things about Postscript is that it is *readable* — a Postscript document description is in plain text which you can display on your screen. Of course, nothing ever goes wrong in computing, so you never need to see or understand a line of PDL program: but if you ever did, then this feature could be very comforting. Naturally the bread and butter of any PDL has to be the setting of type. The simplest situation is also handled straightforwardly in Postscript.



```
% ------------------------ Star ----------------------------

the_font findfont
[the_fontsize 0 0 the_fontsize neg 0 0] makefont setfont

% These put the inner points in a different place.
% /x1_co_ord 54 cos 54 sin mul 2 div the_radius mul def
% /y1_co_ord 54 sin   dup  mul 2 div the_radius mul neg def

/x2_co_ord 72 sin the_radius mul def
/y2_co_ord 72 sin 54 sin div 54 cos mul the_radius mul the_radius sub def
/x1_co_ord y2_co_ord x2_co_ord mul the_radius neg y2_co_ord add div def
/y1_co_ord y2_co_ord def

274 364 translate

newpath
0 the_radius neg moveto

1 1 5
{
 x1_co_ord y1_co_ord lineto
 x2_co_ord y2_co_ord lineto
 72 rotate
} for

% fudge cos closepath makes a mess of the star
x1_co_ord y1_co_ord lineto

3 setlinewidth

gsave
stroke
grestore

clip

% Make lots of text.

/line_end the_radius 4 mul def
/last_line the_radius 2 mul def

/str_width the_text stringwidth pop def
/str_len 0 def

the_text
{
 pop                    % don't actually want the character
 /str_len str_len 1 add def
} forall

/str_inc str_width str_len div def

/num_in_line line_end cvi str_width cvi idiv def

the_radius neg dup moveto

% for each line of height fontsize
1 the_fontsize last_line
{
 % for each string length
 num_in_line
 {
  the_text show
 } repeat
 num_in_line str_width mul str_inc add neg the_fontsize rmoveto
} for

showpage
```

For example:

```
/Helvetica findfont    %Extract the Helvetica font
12 scalefont setfont   %Scale to 12 point
288 720 moveto         %X, Y co-ords (units of 1/72in)
(This is sample text)show   %Print the text
```

Postcript comes with four fonts: Times Roman, Helvetica, and Courier, all in standard, italic, bold, and bold-italic; and a symbol font including Greek and mathematical symbols. There are facilities for you to scale and rotate characters, and to produce them in solid or in outline forms. You can modify an existing font (to add accented characters), or even create a completely new font of your own.

New fonts can be defined:

— as the boundaries of graphical shapes, defined as sequences of straight lines and arcs, which are automatically in-filled in solid black (or even in half-tone)

— as lines and arcs, drawn with a 'pen' of constant thickness

— as matrices of black and white dots (a 'bit map')

The first of these is the approach most frequently employed. Imagine the amount of work necessary to convert even the letter 'g' for instance into a complete set of bounding lines. (There's licence money in it too, as well as work, for many well-known typefaces are copyright.) You can also imagine the amount of computational work a Postscript interpreter has to do in scaling and rotating and filling the inner bits of just one such character: Postscript helps you to avoid unnecessary repetition of such calculations by giving you control of a temporary store or 'cache' where transformed characters can be held for re-use. And if you want to set text in a foreign language with characters running from right to left or top to bottom, then Postscript is ready for that too.

As well as text, Postscript has facilities for handling pictures as lines and arcs, or as 'bit maps'. (Actually

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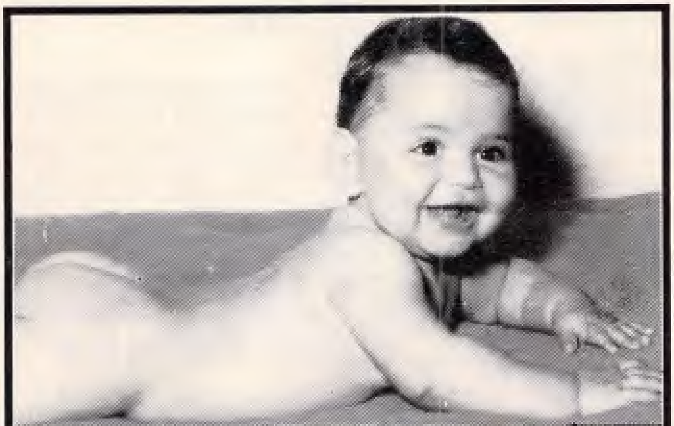

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THE STRUGGLE FOR SUPREMECY IS ABOUT TO COMMENCE

Microtex 666 has announced a date for the commencement of GGC-II, the second game in the Great Galactic series, and is currently accepting registrations.

This is a real event, with interest across Australia and around the world having been sparked by GGC-I. **Prize money** has been increased to **$5795.**

The GGC is an Australian multi-user game played on the **Telecom Viatel** service, with support for up to **1,000** players. The first game, GGC-I, attracted some 360 players and was played over a period of three months in late 1986. Based on feedback from participants, Microtex 666 has enhanced the game, redesigned the database, eased Hyperspace rules, abolished the joining fee, and reduced playing costs. Initial registrations indicate that these alterations, supplemented by the testimony of GGC-I players, have caused membership to soar and Microtex is steeling itself for the full 1,000 players.

The GGC is a game of **strategy and negotiation**, not a "Shoot-em-up" arcade style test of reaction speed. The scene is set late in the evolution of the galactic empire. Each Warlord, under his or her chosen pseudonym, commands battle fleets from a series of planets. A great expansion in the universe has given rise to the conflict, with Warlords struggling against each other to control as much territory and as many fleets as possible, thereby becoming galactic ruler. Two moves, or "phases" are played each week, with Warlords secretly sending their fleet orders to the Microtex computers. The key to the game, however, lies in the forging of alliances through which several Warlords may act together in a common interest. Negotiation between Warlords is via the Microtex Com-Link, bulletin boards, and private inter-player messages. All communications are based on pseudonyms, so individuals have no idea with whom they are really dealing. This is an essential component of the game, as alliances are often broken and reprisals often launched.

Players in GGC-I found the event to be engrossing, exhilarating, and quite social. The strategic nature of the game appealed to **business people, professionals, students, banks, other countries and strategy game enthusiasts.**

First prize is an Atlantis International PC/Turbo system resplendent with printer and valued at $1895. Runners up will receive $1000 and $250, and there are an additional twenty-five consolation prizes of $50. Joining GGC-II is free to Microtex 666 members, and the GGC database has been redesigned to minimise player connect time. Microtex is charging three cents per minute over the normal Viatel connect charges, and estimate that players should be able to partake in the game for as little as $1.80 per week. Private messages between players are charged at five cents, merely covering costs with no profit to Microtex 666.

The game commences on Friday, April 24 and will consist of two test moves for player orientation, followed by sixteen phases over eight weeks. Registrations will be accepted until April 15. Players will receive maps, rule books, battle locations and confirmation of their chosen pseudonym.

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- Adapter: HDD/FDD controller (WD chip)
  Parallel/Serial card
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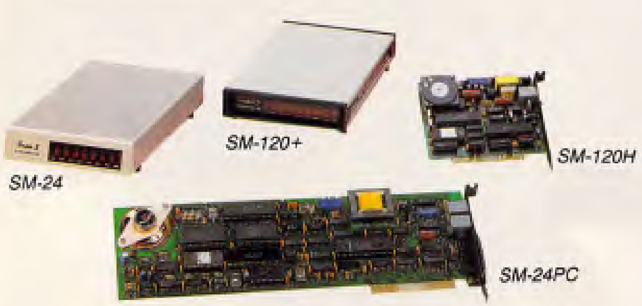

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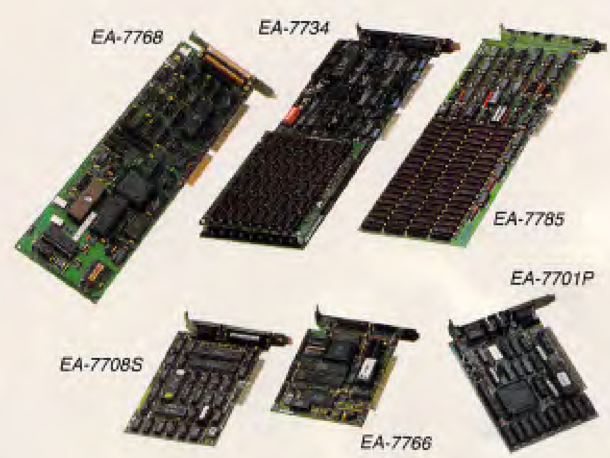

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type characters are really just complex graphical shapes). There is a full range of mathematical operators for computing drawing co-ordinates: this part of the language is highly stack-orientated,

> *'Postscript has facilities for handling pictures as lines and arcs'*

which you may love or hate, according to taste. What in a more conventional programming languages would be rendered as:

x:=x+1

in Postscript becomes:

/x	%Put the name of variable x on the stack
x	%Put the current value of x on the stack
1	%Put the value 1 on the stack
add	%Add the top two values on the stack (to form x+1)
def	%Define the name second on the stack (i.e. /x) % as the value now on top of the stack (i.e. x+1)

Of course you can express this more succinctly as:

/x x 1 add def

but you may feel that a thorn by any other name is just as horrid.

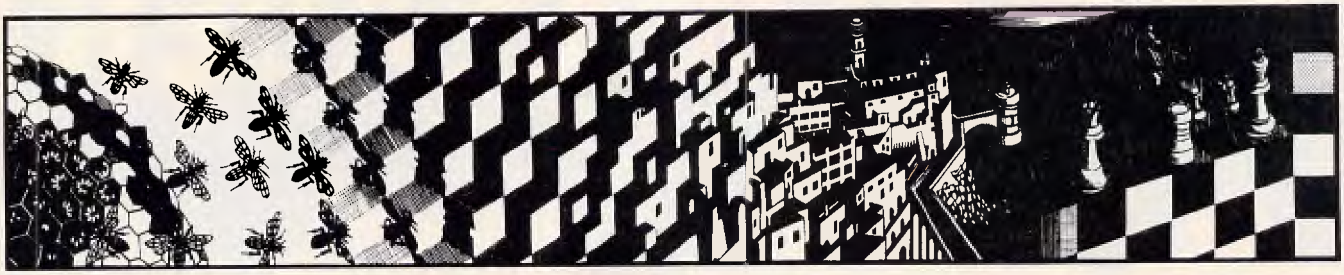
Like most programming languages, Postscript includes a facility to define procedures. These can be called over and over again to repeat frequently used illustrations or units of text (for example, page headings). Typically a page or document will be specified in Postscript as a set of procedures followed by calls upon them to produce the required output.

Conclusion

The battle for recognition of one (or possibly more) standard page description languages will continue to rage over the coming months. We hope this article will have shown you how important the results will be to all of us.

END

As this issue went to press, IBM announced in the US that it has signed a licensing agreement with Adobe Systems to support Postscript in future IBM electronic printing products — Ed.



In this month's Screenplay Stephen Applebaum braces himself for some mental aerobics with Shanghai, and gives Reagan's SDI program a trial run.

Shanghai's ancient surprise

TITLE: Shanghai
COMPUTER: Amiga, C64, Macintosh, Apple, Apple IIGS, IBM
SUPPLIER: Imagineering
PRICE: $68.80, $38.60, $69, $49, $85, $68

Men have lost everything they own over it. Some have made their fortune through it. Others have even died from being involved with it. Mah Jongg, a game which originated in China some three million years ago, has had a chequered and often bloody history. It began as a card game played among sailors and fishermen to while away the long, lonely hours spent at sea. Over the years, the cards were replaced by the bone and bamboo tiles we know today because their weight made them less prone to fly off the decks.

During the prohibition years of the 1920s, Mah Jongg became one of the most popular forms of gambling in the US. The game proved to be so soul-destroyingly addictive that it was actually banned in Philadelphia.

Mah Jongg is now as highly regarded as chess, having thrown off its ancient dark image. If you have never played it, or even heard of it, then you can sample some of the flavour of the game in a derivative of Mah Jongg called Shanghai.

Shanghai employs the same tiles used in Mah Jongg, although the two games are quite different. The newer format is very much simpler than its ancient predecessor, but don't be fooled. Below its deceptively uncomplicated exterior lie hidden depths into which the player can be pulled, only to be lost in a web of frustratingly complex strategy.

There are 144 tiles in Shanghai. And, since the orginal form of Mah Jongg was a card game, 108 of these are divided into three suits. Each of the suits has a name and an individual history. For example, the suit of Dots, one of the oldest of the three, goes back as far as the original sailor's game. The dots resemble coins, and it is therefore supposed that they represent the root of all evil — money.

Alongside the suit of Dots are the suits of Bam and Crak. The former represents bamboo, because that was the material used in the ancient Orient to make spears; while the latter, Craks are characters or actors, and are represented either by real people or the letters that go to make up the Chinese alphabet.

Besides the three suits, there are four smaller groups of tiles made up of only three or four units. The most interesting are the three Dragons, each of which is associated with one of the three suits just described: white dragons are associated with Dots, red dragons with Craks, and green dragons with Bams. The Winds, the Seasons and Flowers are the other three groups.

At the start of play, the 144 Shanghai tiles are laid out in a set formation called the Dragon. Viewed from the side, this looks like a kind of pyramid. Seen from above, which is the angle that the layout is displayed from throughout the game, all the tiles appear to be on the same level; in reality, some stacks are higher than others. As the computer doesn't let you see the construction from the side, tiles are edged with a specific colour to indicate which level they are really on.

The object of Shanghai is simply to remove as many pairs of identical tiles from the Dragon as you can. Only tiles on the same level can be matched, and then only if they can slide out to the left or the right.

Shanghai features four slightly varied ways of playing the game. The first, 'Solitaire', is, as the name implies, designed for one person. If, on the other hand, more people want to play, 'Team Effort' allows any number of players to pool their skills in winning a game. This variation is much the same as 'Solitaire' except that play rotates from person to person, with each one removing a single pair of tiles from the Dragon.

'Tournament Shanghai' is rather harder than the previous two modes because it is played against the clock. And when competing against the clock becomes too easy, accomplished players can progress to 'Challenge Shanghai', where two people meet in a head-to-head competition to see who can find the most moves in a game.

One of the nicest features of Shanghai is the way that nothing has been left to chance. As well as designing a

graphically beautiful playing screen, the game's programmers have also included all Shanghai's rules and play options among a collection of pull-down menus. If you mislay the manual, you needn't give up playing the game.

Shanghai is by far one of the best strategy games to come onto the computer market in a long time, which just goes to show that the old ideas are still the best.

People who live in glass houses . . .

TITLE: SDI
COMPUTER: Atari ST; Amiga; Commodore 64
SUPPLIER: Imagineering
PRICE: $79, $79, $49

In an attempt to make a fast buck, many software houses are diversifying by marketing programs written out of house. Although this is good short-term strategy, it can — and often does — do irreparable damage to the company's credibility in the long-run.

I'm sorry to have to say it, but now even Mindscape has fallen into the money trap and started to distribute software that really isn't worthy of the company's name. One of the companies that Mindscape has recently taken under its wing in the US at least, is Psygnosis, whose products are hardly worth mentioning.

The stunningly picturesque Defender Of The Crown, reviewed in February's *APC*, proves that Mindscape hasn't totally lost its touch. That said, SDI, the second in the Cinemaware series (of which Defender Of The Crown was the first), exhibits a massive drop in quality coupled with a needlessly politically-biased storyline.

You will no doubt know that SDI stands for Strategic Defence Initiative, the proper title of Ronald 'I didn't know a thing about it' Reagan's Star Wars project.

The real-life SDI is a plan to deploy killer satellites armed with lasers that can shoot down nuclear missiles launched by a foreign power against the United States of America. Reagan is pushing SDI as a peace-keeping device because its role is defensive. What he fails to recognise is that by instituting such a system, he is not averting war but preparing for it.

SDI the game contains a storyline that is subtly supportive of Reagan's 'protective umbrella'. The only way to win the game is by keeping the orbiting satellites operational so that they can knock out incoming missiles orginating from the Soviet Union.

When the game begins, Russia is in a state of internal turmoil: the Red Army and elements of the KGB are marching on Moscow with the aim of

toppling the Communist government in a *coup d'etat*.

Reports coming out of Russia state that the KGB has already taken control of several Inter-Continental Ballistic Missile (ICBM) sites, as well as the Yuri Alekseyevich Gagarin Spaceport. Worse still, it has launched vast squadrons of small fighter craft to cripple the SDI satellites and commandeer the VI Lenin Space Defence Station.

As Sloan McCormick, Captain of the Orbital Marines, it's your task to command the American SDI force in the battle against the KGB-led revolutionaries. On your side is Natalya Kazarian, commander of the VI Lenin Space Station, and together you must fend off the intransigents and stop the start of World War III.

Unlike Defender Of The Crown, SDI requires very little — if any — mental exertion on the part of the player; it's simply a very classy shoot-em-up in the Star Raiders mould. Like the preceding Cinemaware program, however, SDI is made up of several loosely connected sub-games, each of which has its own little scenario.

The curtain rises on Sloan McCormick's enterprise to reveal him surveying the wall of flickering video screens in the control room of the US space station. Four of the screens are operational, and can be enlarged to fill the entire display by selecting each one individually with a cross-hairs cursor.

Two of the screens give access to the SDI control and these are the most important of the four, since through them you can target the satellites on the incoming missiles. Selecting either of the SDI control screens produces the following information: primary satellite status (functional or damaged); missile destination (the name of the American city for which it is headed); satellite number (1 to 12); and missile coordinates.

Having provided the information, the program then prompts you to select either primary or secondary satellite sequencing. (As far as I can see, the only difference between the two is that the likelihood of hitting a missile with a primary satellite is greater than with a secondary one). Finally, you must choose whether to use a full beam or pulse. The former provides a single, high-powered blast which is easy to aim, but only gives you one chance to hit the target; the latter is more prolonged, and is designed to be used with secondary sequencing.

Most of SDI's action takes place in a small fighter ship in which you can hurtle through space, shooting down the hordes of KGB battle-craft that threaten to destroy the orbiting satellites protecting Uncle Sam. This part of the game is very similar to — indeed, almost identical to — Star Raiders.

Occasionally a satellite will begin to flash, indicating that it's in need of repair. To put the device back into operation, you manoeuvre your ship so that the satellite is aligned with the middle of a square in your viewfinder and press a button, thus activating the repair process.

Docking with either the American or Russian space stations is a similar operation to that just described for repairing a satellite, except that when you have lined up your ship with the station and pressed a button to activate your craft's onboard docking computer, you must then steer your way through the three-dimensional hanger domes of the station. Once aboard, you can carry out any necessary maintenance on your craft.

At some point in the game (or so the instructions say — it never happened when I was playing), the KGB will overrun the Russian space station. Should this happen, you must rush to the rescue of Natalya.

SDI is a poor follow-up to Defender Of The Crown, but is still better than a lot of games of its ilk. Hopefully future Cinemaware products will steer clear of politics and the arms race, as it's impossible to handle serious issues constructively in a computer game.

END

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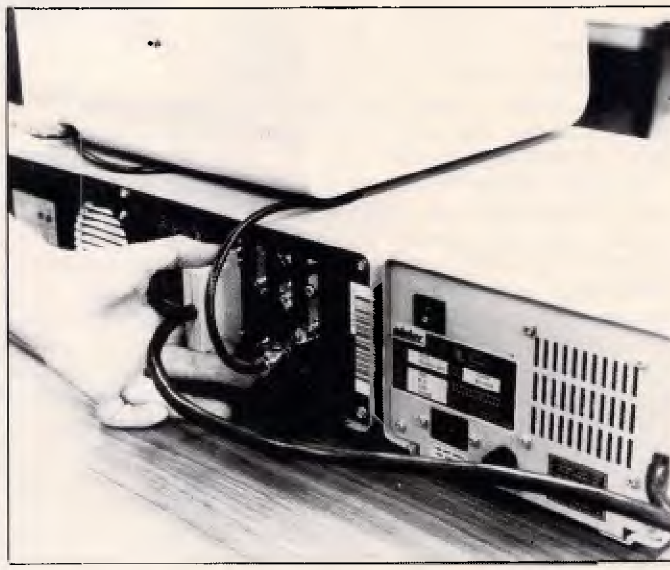

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PCs and the Law

The legal standing of computer programs and security has always been a bit hazy. Computer lawyer, Gordon Hughes sheds some light on the current state of computers and the law.

'Law-making tends to move slowly, in the hands of non-technologists. Computing technology has developed rapidly, beyond the understanding of all but a few laymen and most laywers'.
The Hon Mr Justice MD Kirby, July 7, 1981.

Computer enthusiasts are becoming increasingly concerned about the extent to which their activities may be regulated by law. Much attention has been focused in recent times on the question of whether hackers or pirates are in breach of the law. All computer users are entitled to feel confused: there is no doubt that the law is presently beset with uncertainty.

There are two major activities which give rise to this legal dilemma. The first involves the unauthorised copying of a computer program; the second involves unauthorised access to data stored on a computer. Such acts may, in certain circumstances, breach copyright law, criminal law or the common law doctrine of 'confidentiality' but the issue is far from clear.

Copyright

Copyright is regarded as the main weapon for software houses seeking to deter pirating of their programs. The Copyright Act has always extended protection to original 'literary, dramatic, musical or artistic' works and it has long been argued that a computer program constitutes a 'literary' work.

While it is not difficult to equate a program in source code with literary work, the classification is a little more artificial where object code is concerned. This was certainly the view of the marjority of judges in the High Court decision of *Apple Computer Inc v Computer Edge Pty Ltd* which interpreted the Copright Act in a judgment handed down on May 6, 1986. The majority clearly had difficulty equating a series of electrical impulses on a silicon chip with a traditional literary work and therefore held that Computer Edge had not been in breach of copyright when it copied the object code of the Applesoft and Autostart ROMs. The result may have been different if Computer Edge had copied Apple's source codes.

In anticipation of this High Court decision, the Copyright Act was amended on June 15, 1984 and now provides greater protection to programs copied without authority after that date (the programs which were the subject of the Apple Case were copied earlier).

> *'A person who, without authority, copies a program belonging to another or who, without authority, extracts data from a computer system, runs the risk of committing a criminal offence.'*

A literary work is now defined as including a 'computer program' which, in turn, is defined as meaning expression 'in any language, code or notation' which, after conversion to another 'language, code or notation' or reproduction in a different material form, is designed to drive a computer.

Unfortunately, however. this is not the end of the uncertainty, despite the clear intent of the legislation to extend cover to programs in object code. Legal academics still believe that the technology of object code does not sit comfortably within the concept of 'language, code or notation' in the context of the legislation. It would appear, therefore, that the question of whether copyright exists in object code will remain unclear until there is another High Court challenge.

Controversy has also arisen recently over whether copyright exists in the 'user interface'. This issue, known to lawyers as the 'copyrightability of look and feel software', has surfaced in the United States and the argument will doubtless spread to Australia. The problem arises where a format (such as the grid produced on a screen by Lotus 1-2-3) is copied without reference to the underlying programming code.

This problem was initially identified when the United States Supreme Court handed down its decision in *Whelan Associates v Jaslow Dental Laboratories* in 1985.

The defendant engaged the plaintiff to write a program in the EDL language but the work was not completed. The defendant then engaged a third party to complete the programming work, which the third party did using Basic language. The program partially developed by the plaintiff and the program produced by the defendant were similarly structured in the way information was organised, retrieved and used and the screen displays generated by the two programs were virtually the same. The Court held the plaintiff was entitled to copyright protection over the earlier program. The right arose out of the 'look and feel' of the programs. The Court noted that, as between the two programs, 'the visual screens that are displayed are almost identical in format and in use of abbreviations and terminology'.

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this finding, actions have subsequently been brought in the United States by companies including Lotus, Microstuf, Cadam, Manufacturer's Technology and Broderbund Software. Most of these cases are yet to reach judicial decision.

These actions add a new dimension to the copyright debate. Until now, a majority of commentators have sympathised with the large software houses in their attempts to stamp out unauthorised copying of their programs and this has produced, among other things, the amendments to copyright legislation both in Australia and overseas. These new claims to a proprietary right in the user interface, however, are seen as an unreasonable attempt by the large software houses to stamp out innovation and competition.

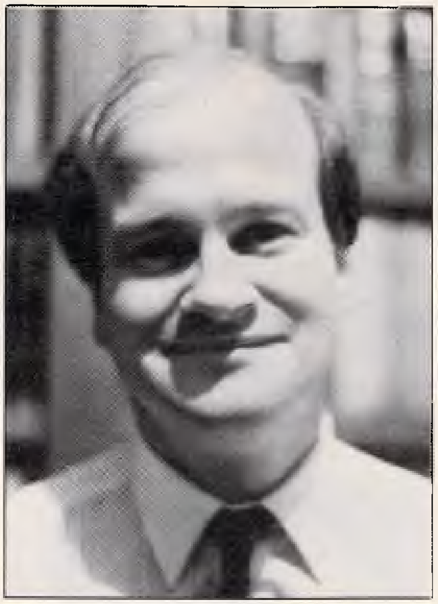
In any event, there are still many unanswered legal questions, including whether Australian copyright legislation extends protection to 'look and feel software' and, if it does, the extent to which the user interface must be innovative and unique to qualify for protection. Indeed, the position is far from clear even in the United States, where the US Court of Appeal's January ruling in *Plains Cotton Co-op v Goodpasture Computer Service* expressed doubt as to whether the *Whelan Case* would be followed in every instance.

Confidentiality

If copyright law is the primary weapon used by the software developers to protect their ideas, then the rather obscure law of confidentiality is the primary weapon available to persons seeking to prevent unauthorised access to data stored on a computer.

This issue arises mostly in connection with computerised personal information. Can one person prevent another gaining access to such information without authority? The problem exists both in the public sector (for example, health, taxation and criminal records) and in the private sector (for example, employment applications, payroll details and insurance claim forms).

Some *ad hoc* controls already exist in the public sector. For example, the National Health Act imposes a general obligation of secrecy on the Department of Health and the Income Tax Assessment Act imposes a general requirement of confidentiality on officers of the Australian Tax Office. Such controls extend to government employees who have access to computerised infor-



Gordon Hughes. a Melbourne computer lawyer, has been awarded one of two 1987 Menzies Scholarships.

mation. In the private sector, on the other hand, there is no specific legislation in force, unlike the United Kingdom, for example, which has enacted the far-reaching Data Protection Act.

In the absence of specific legislation, the individual may have a right under the common law duty of 'confidentiality' to prevent unauthorised access to or disclosure of personal information in some circumstances. Certain criteria must be established in order for the law to recognise that this duty of confidence exists. The information must have a degree of 'secrecy' or 'confidence' about it; the information must be supplied in circumstances where an obligation of confidence exists (including professional relationships and perhaps employer/employee relationships); and there must be a threatened or actual unauthorised use of the information by another person to the detriment of the confider. Where these principles are breached, it would appear equitable remedies (such as an injunction) and damages may be pursued against the offender.

In its report on privacy in 1983, the Australian Law Reform Commission commented that notwithstanding the possible existence of confidentiality remedies, 'proper protection of information and privacy should be principally concerned to prevent the misuse of information in advance'. The Commission therefore recommended the enactment of federal legislation governing the storage of information in certain cir-

cumstances and this, inevitably, extends to information contained in a computer databank. Such legislation has not been enacted, however.

Individual states have also given the matter some attention. In New South Wales, a Privacy Committee was established in 1975. The Committee investigates and reports on invasions of privacy and has produced 'guidelines' for the manual and computerised storage of data in both the public and private sectors. The Western Australian Law Reform Commission has also been looking at the problem for some years now but has not yet produced its final report.

The issue has again emerged in the Australian Card debate. Because of concerns about the confidentiality of personal information stored in the Australian Card databank, the Privacy Bill was introduced in 1986. Under this proposed legislation, Australia would have adopted the recommendations of the Organisation for Economic Cooperation and Development on privacy and strict obligations would have been imposed upon Commonwealth government agencies who had control of personal information relating to individuals.

The legislation would have extended to information stored in computer databanks under the control of Commonwealth government agencies and under clause 42 of the Bill, a person could be legally prevented from gaining access to that information without authority. The legislation would not, however, have extended to information stored by private organisations. In any event, the Privacy Bill, like The Autralia Card Bill, has not been enacted.

Criminal Law

A person who, without authority, copies a program belonging to another or who, without authority, extracts data from a computer system, runs the risk of committing a criminal offence. However the issue is again far from clear under the present law.

To the layperson's mind, it might appear quite logical that such activities should be classified as 'theft' but there are in fact fundamental problems. Theft is an offence against property, and there is ample authority for the proposition that mere information does not constitute property in this context.

Theft also involves the notions of 'appropriation' and 'intention to permanently deprive' yet, like the unauthorised use of a motor vehicle, there is rarely a provable 'intention to permanently deprive' the owner of the program or information.

Attempts have been made to catch hackers and other computer abusers under other heads of the criminal law. The offences of criminal deception and forgery have been mentioned. Sometimes legislative offences relating to false accounting, suppression of documents, unauthorised use of electricity or the record keeping requirements of Companies Code may be committed but these circumstances are comparatively rare and the application of the law often tenuous.

Because of these uncertainties, considerable attention has been paid in recent times to introducing legislative amendments to criminalise the activities of hackers. In New South Wales, a Crimes (Computer Abuse) Bill was drafted in 1984 but was not enacted. A Crimes (Amendment) Ordinance relating to computer abuse was enacted in the Australian Capital Territory in 1985 but is only of limited application.

Recently, the Joint Standing Committee of Attorneys-General has been meeting in an attempt to create a uniform criminal code between the states specifically directed at this type of activity. However at its last meeting in Adelaide on March 5, 1987 the Committee was unable to reach agreement and the reasons are significant.

The impasse appears to be the result of disagreement between the states as to the extent to which hacking and similar activities should be criminalised. In the same way that concern is now being expressed over the prospect of excessive copyright protection being granted to software houses, there is growing concern that to criminalise hacking may be an over-reaction. For example, does anyone seriously regard an employee playing games on the boss's computer during a lunch break without authority as a criminal? And, why, for that matter, should data stored on a computer be accorded protection by the criminal law which does not apply to manual data recording systems?

This change in public sympathy was first perceived when the Tasmanian Law Reform Commission produced a report in 1986 which was criticised in some quarters as being 'too sweeping' in recommending, without qualification, that the unauthorised use of a computer should be a crime. The Commission recommended the introduction of a series of specific criminal provisions relating to six separate problems — computer related fraud, damaging com-

puter data, unauthorised use of a computer, unauthorised access to a computer, dishonestly inserting false information as data and dishonestly omitting to introduce, record or store data.

No-one seems to doubt that computer use and abuse requires legal regulation — whether such use or abuse should, in the majority of instances, be accorded criminal status is another matter.

The uncertainty will continue for the time being as different states approach the problem in different ways, now that the Joint Standing Committee of Attorneys-General has given up the quest for a national code. Victorian Attorney-General, Jim Kennan, has foreshadowed draft legislation later in 1987, as has the New South Wales Attorney-General, Terry Sheahan. The nature of such legislation, and the attitudes of the other states, remain unknown at this stage.

Conclusion

Persons who, without authority, copy a program or extract information from a computer run the risk of breaking the law. Where the copying of a computer program is concerned, there may be a breach of copyright although this is debatable where the program is copied direct from the object code; it is less likely that a criminal offence has been committed. Persons who gain access to information stored on a computer may be in breach of the law if the information is classifiable as 'confidential' and in some circumstances may be in breach of specific legislation governing the storage of the data in question; again it is unlikely that the criminal law has been breached in these circumstances. The law will inevitably change in all areas over the next two years or so but the nature and extent of such changes is difficult to predict.

The Scholarships are awarded by the Australia-Britain Society to facilitate research of mutual relevance to the Australian and British communities.

Mr Hughes has written three books and has published over 20 articles, principally in the computer law field.

Mr Hughes is a partner in the Melbourne law firm of Lander & Rogers. He proposes travelling to Britain in August under the auspices of the Scholarship in order to complete his research into problems arising from the interaction of computers and the law.

END

SCREENTEST

Protext

The Amstrad PCW8256 already comes bundled with word-processing software in the form of Locoscript, so users might wonder why they should fork out $279.75 for a word processor called Protext. Diane Haymer has tried out the package and describes its advantages.

The appearance of the Amstrad PCW on the market with a price tag within most people's reach was a dream come true. Complete with its own software package — Locoscript — Amstrad took word processing to the masses. The dreamlike quality of Amstrad's Locoscript tarnishes slightly with familiarity, particularly for those used to working on more sophisticated word-processing software. In attempting to produce a word- processing package that was cheap — and easy to use for the beginner — Amstrad had produced a program that was both slow and cumbersome.

But along comes Protext, a new software package that has all — or most — of the answers to Locoscript. Protext is produced by Arnor and runs on the Amstrad PCW8256, the PCW8512 and the CPC6128. Increased speed and efficiency of editing is Protext's major drawcard, but other special functions enhance its appeal. These include a spelling checker with a 33,000-word dictionary and a mail-merging function.

Set-up

Installation of Protext is similar to preparing Locoscript for use: with a prior knowledge of Locoscript it took little time to create a Start of Day disk, copied from the Master via the Amstrad CP/M software. The Dictionary disk is copied onto a separate disk from within Protext itself, and Protext is ready for use.

The basic set-up of Protext is quite different from Locoscript. Protext replaces Locoscript's familiar disk manager with a 'Commander' mode screen. Commands are entered in the bottom half of the screen with the current document consigned to the top half of the screen.

The beauty of the Protext set-up is the rapid movement it enables between Command mode and editing the current document. Toggling between the two via the STOP key is instantaneous — no more waiting while the remainder of the document is scrolled through before exiting. Re-entry into the current document is also just as quick.

The Command mode's one drawback is that it does not display the documents and groups on disk automatically as Locoscript does, but will only do so with a further instruction — CATALOGUE — and then only one group at a time. It also does not display automatically the amount of disk space left — again, it only does so when the CATALOGUE command is given. A special print command enables hard copies of the files on catalogue to be printed.

Protext's Command mode takes some getting used to for a user conversant with the old software, as its principles for operation are quite different from Locoscript's disk manager. One illustration of this is the different method by which documents are created within Protext. On the Locoscript software, a new document is created from the disk manager screen with the 'C' command (Create) — a very straightforward command on Locoscript.

Not so on Protext. I spent several hours trying without success to create a new document: the most I could achieve for a long time was to rename the document already on the screen — the only alternative appeared to be to switch off the machine and reload the Start of Day disk. My plight was not relieved by the manual, which has no specific chapter or section that deals with creating new documents. The confusion I endured is worth mentioning, as I'm sure it will be experienced by users familiar to word processing as well as those new to it.

Toggling out of Edit mode and into Command mode does not actually close the current document. Further steps are necessary in order to complete editing one document and open another: toggle into Command mode then copy the current document in memory to disk, via the SAVE command. The document currently displayed in Edit is then saved, and the screen can be cleared to prepare for another document to be opened and worked on. This is performed by typing 'CLEAR' in Command mode, which removes the current document from the memory. The top half of the screen above the Command mode prompt line is now empty, and the status line indicates that there is a new file which, as yet, has no name. The file can be named now or later via the NAME command in Command mode. Toggle into edit via the STOP button in order to begin work on the new document.

Some similar functions are performed in Command mode as were carried out in Locoscript's disk manager — naming and renaming documents,

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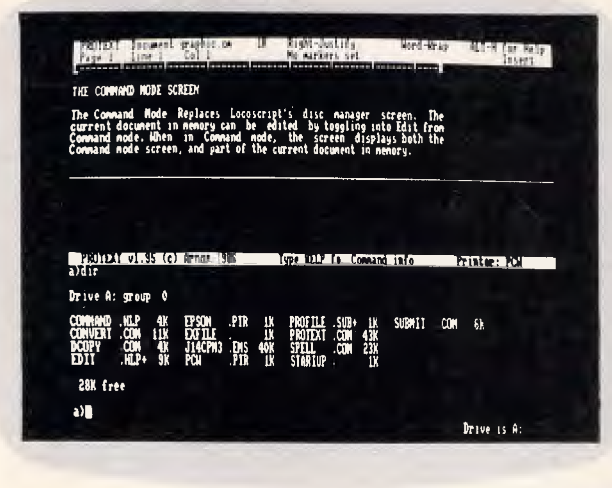
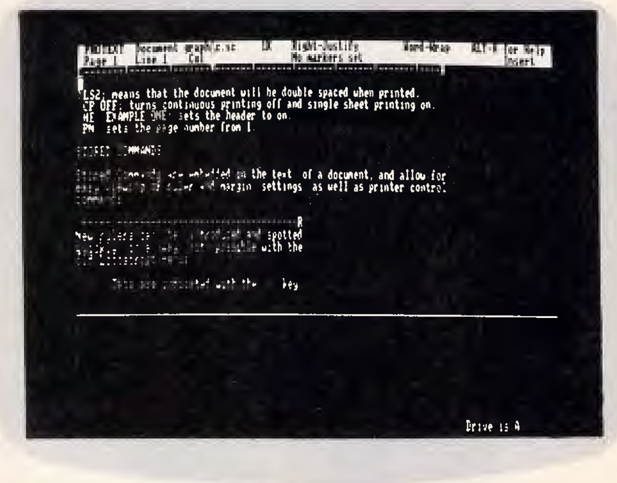


The basic working screen shows current document status and cursor position. Pressing STOP opens a command window from which documents are printed. From here it is also possible to format disks



Commands to alter format and printing can also be entered as part of a document and saved with it to disk. Multiple line headers are possible and a number of rulers can be used in one file

copying documents, storing blocks of text, and printing. Locoscript's FIND command has been replaced with FIND and REPLACE in the Command mode, and is capable of performing far more sophisticated procedures.

In addition, Command mode offers an extensive range of new functions; it can count the number of words in a document or block (through a COUNT instruction), merge documents together (MERGE), and allow the contents of one document to be read while another is edited (TYPE).

Disks can also be formatted from the Start of Day disk within the Command mode without ever having to return to CP/M. The spelling check is also accessed from within the Command mode.

Editing

It is within editing that Protext really comes into its own. The most tedious and time-consuming task on Locoscript is working on long documents — movement around the text involves scrolling through entire pages to get to the relevant position. Protext has ironed out Locoscript's speed flaws, and allows for ease of movement to and from any point within the text by a series of command accessed through the ALT key (or CONTROL key for CPC users).

The ALT key combined with a range of other keys enables leaps paragraph by paragraph, screen by screen, and page by page, as well as a command to return to the previous cursor position. Once the user is familiar with the different combinations, these functions are a tremendous editing aid (a summary of the different key combinations and their functions is provided in an appendix in the back of the manual).

The most welcome advance on Locoscript is the GOTO function in Protext which enables rapid movement through a document — for example, from page 1 to page 20, or vice versa, without having to scroll through the 19 pages in between. Protext can also rapidly delete large or small amounts of text — and can undelete them (ATL-U) until further text is deleted!

One of the less welcome changes to the scrolling capacities of Protext is the *way* it scrolls. Once the cursor is moved to a line below the current screen display, the whole text is rewrit-

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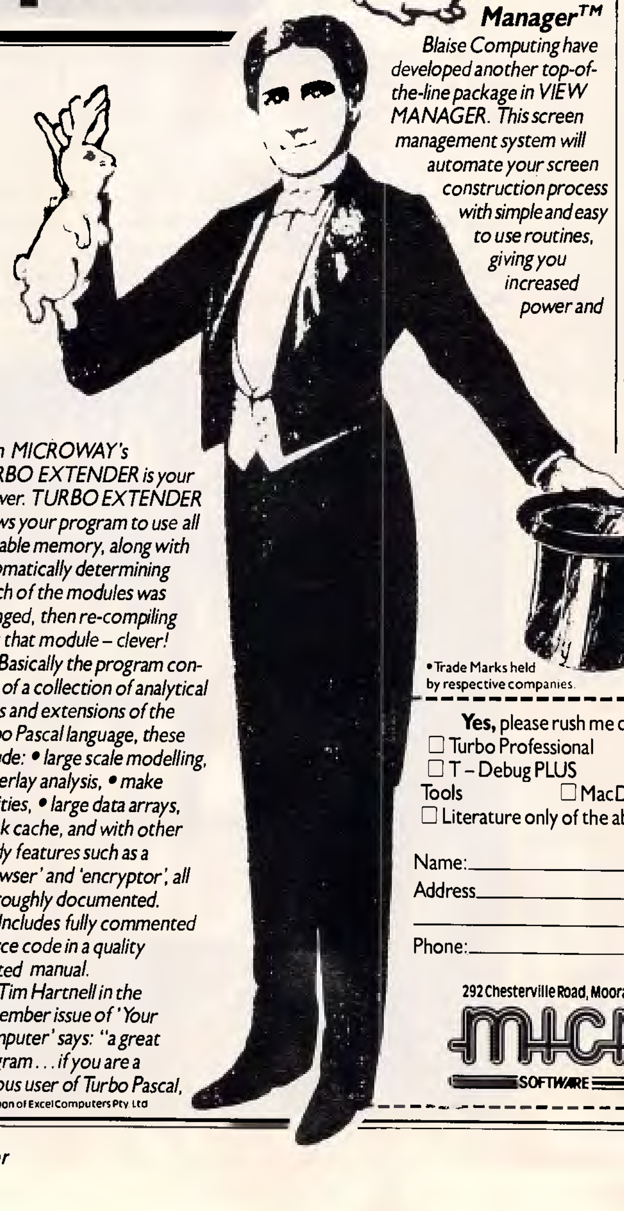

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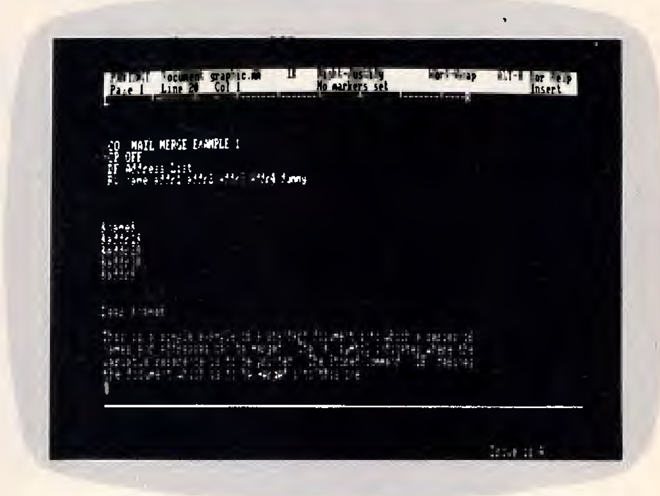
The spelling checker shows you the context for each mistake it finds and suggests possible correct words. Users can create their own dictionaries and the speller also gives you statistics about your document



Variable information in mail-merged documents is shown by names surrounded by ampersands. The DF stored command shows which file holds the variable information. RV indicates the order the variables are stored

ten rather than being simply shifted one line up. This makes reading from the screen extremely difficult, as the text disappears as the document scrolls up or down.

Features that I particularly liked were the ability to toggle between 'Insert' and 'Overwrite', to transform text from lower case to upper case, or vice versa, with a single command (ALT-/, ALT-, respectively), and the more sophisticated 'Cut & Paste' functions. As well as the old Locoscript capacity, Protext can cut or copy a section of text (called a 'Box') and lay it out to the right of existing text. In this way, magazine-style column layout can be achieved on the screen and in print.

Text can also be shifted between any two documents at a time because of Protext's ability to hold two documents in memory simulatenously. Using this facility I could keep my notes on the one file while working on a main document. And like Locoscript, Protext enables blocks of standard text to be stored as separate documents on disk and inserted into other documents.

The cut and paste function still appears to have some bugs — there is no way to store more than one piece of text once cut to be pasted within the same document. Locoscript offers up to ten paste buffers. Even moving one piece of text around a long document was difficult — a block only appeared to remain in memory over about three pages, after which an attempt to paste was met with 'Block not in memory' on the status line. It seemed that the only way to move blocks was to paste them once, then paste them again at the correct point.

The greatest difference in Edit mode between Locoscript and Protext is the replacement of menus with a series of 'stored commands' that are embedded in the text. This means that the editing functions are initially harder to remember and constant reference to the manual is necessary, but with increased familiarity it becomes easier to use the editing functions without the old Locoscript menus. With the new software, you never have to leave the text you're working on (except in 'HELP', which opens a window at the bottom of the screen).

Stored commands are instructions placed within the text — usually on a separate line from the rest of the text —

but which are *not* printed when the text is printed. Stored commands set up layout and printing information, as well as mail-merging instructions. These are acted upon at print time. A 'Print to Screen' instruction in Command mode enables a document to be viewed as it will appear on paper, before printing. The stored commands can be printed out, and *not* acted upon, from the 'Program' mode, also accessed via Command mode.

The stored commands perform more or less the same functions as the old menus, but with much less fuss. Rulers and margins, headers and footers, page numbering and formatting are all set on the editing screen — the instructions embedded in the text of a document are indicated with a ' > ' at the beginning of a line. Each command is easily identified from its position within the text — rulers, for example, are displayed on the screen permanently while editing and new rulers are easily spotted — a vast improvement on Locoscript's system of storing a number of ruler settings within a separate menu.

As with ALT functions, I found the sheer quantity of stored commands overwhelming at first, and a headache to try and memorise. Perseverance pays off, though.

Help command

Help is available in Edit mode and contains a summary of all the editing functions, with their appropriate key combinations. The HELP command is context-sensitive — that is, will initially turn to the HELP page appropriate to the function currently being performed. Instructions for accessing the HELP function are permanently displayed on both the status line in Edit and the Prompt line in Command mode.

Using Locoscript documents on Protext

It is possible to transfer Locoscript documents to Protext, but it is first necesssary to save the Locoscript files in ASCII format. This is done from the disk manager with the f7 command key. Once saved, the file can be loaded into Protext and converted into suitable Protext format through the Utilities program. Documents created by WordStar and other packages can also be accessed in the same way.

However, when I came to convert my old Locoscript documents through the creation of an ASCII file, I was unable to achieve the correct conversion to a Protext document. Left as an ASCII file, the document can be read by Protext, but with erratic formatting. Corrections could be done manually in Edit mode (and unless I can work out how to convert files properly, this is what I may have to do). Not recommended for long documents! For users who haven't created any documents on Locoscript, I would recommend that they be created straight onto Protext.

Printing

Print options can be accessed in several different ways — through stored commands, from the Command mode, and from specific print instructions embedded in the text that affect the print appearance (bold, underline, italics, and so on). The differences between these commands are not always self-evident and sometimes duplicate each other. Stored commands can be used to determine how many copies to print, which pages to print, at which page to start and stop printing, whether you are using continuous paper or single sheets, and so on.

The Command mode also offers options as to *where* to print — to disk, to screen (particularly useful when mail-merging in order to check the appearance of the final document before sending to printer), or onto paper; it also permits the printing of selected pages and the printing of files directly from disk, so that background printing can go on while working on another document. The print quality — draft or NLQ (Near Letter Quality) — is selected from Command mode. It is also possible to mark a block of text within a document and print just that. Printing can be stopped, resumed or abandoned completely within Command mode but some use of the PTR key is also required. Direct printing is easily accessed from the Command mode, and from here it is also possible to get a printed copy of the disk catalogue.

In Command mode it is possible to configure Protext for use with other printers. The default setting is the printer supplied with the Amstrad PCW8256, but Epson and Epson compatible printers, once configured provide more facilities. Configuration is done through the Utilities program.

Spelling check

The spelling check has a dictionary of 33,000 words that can be expanded by the user. Access to it is directly through the Protext Start of Day disk, but the dictionary is kept on a separate disk. More specialised dictionaries can be created by the user and stored on the same disk, to be used as a spelling

checker in the same way. The spelling check does not automatically correct mistakes, but takes you through a document, stopping at each mistake, enabling correction then or at a later point, by listing all the misspelt words at the end of check routine. It will also look up the correct spelling of words — the correct word is usually near the top of its list of suggestions, which indicates a good algorithm.

The spelling check looks for both typing mistakes and genuine misspellings, but will not recognise individual characters — my most common typing mistake is to accidentally break up words with a space so that for instance, 'the' becomes 't he'. The spelling check did not pick up this but would pick up 'th e' as 'th' is not a word it recognises. The manual claims that it would pick up 'tHat', where an upper-case letter appears in the middle of a word, but I found that it overlooked some of these errors in my documents. Through the use of 'wildcards' — characters that represent unknown letters — it is also possible to find words and anagrams in the dictionary.

Mail-merging

The mail-merge is apparently capable of performing very sophisticated functions, and its existence is one up on Locoscript. The manual sets out a series of easy-to-follow examples that gradually become more and more complex. The manual recommends that the examples set out be stored as templates for future use.

The mail-merging function starts with the simple merging of standard letters with names and addresses, but can handle much more complicated procedures, such as conditional merging: pieces of text will either be printed or not printed, depending on whether certain conditions are met, and alternative text is printed if the required condition is not met.

Protext can also perform numeric arithmetic in mail-merge. I couldn't help wondering, though, whether the average user of an Amstrad word processor — home users, students and writers — would ever require this sort of mail-merging.

Mail-merging does, however, have another function more immediately relevant to the average user; it can merge one or more documents into the document currently in memory, when printing. This enables more easy handling of large documents, as one long piece of work can be broken up into individual documents, stored separately but printed in one run, with consistent headers, footers and page numbering. The documents will not actually be merged on disk but will remain as separate documents.

In the same way, frequently used standard pieces of text can be stored and accessed. This is slightly different from Locoscript's method — like Locoscript they are named and stored on disk as separate documents, but here in Protext are accessed through a mail-merge stored command embedded in the text of a document, rather than through reference to the disk manager. Text cannot be inserted permanently this way as mail-merging simply runs documents together when printing. It does not store the document/text block in the current document once the document is returned to disk.

Documentation

Protext's manual has no index, and the chapter headings only give obscure and often misleading indications of where explanations of specific functions might be found.

The glossary at the back is limited, and lists only a few of the many technical terms that are otherwise unexplained.

An illustration of the information gaps within the manual is the absence of any explanation as to how to open a new document. This is, to say the least, a gross oversight. The CLEAR command, which is the instruction by which new documents can be created, is obscurely listed about half way through the manual, under 'Miscellaneous Commands'.

I also found the manual to be badly organised — for example, rather than listing all the instructions relating to printing together, or cross-referencing them, they are explained in different places throughout — in the section on stored commands, Command mode and under Set.Print in the Utilities section — according to which type of instruction is required. It is extremely difficult to co-ordinate this information sufficiently to simply print out a document.

Where the manual *is* clear about how to carry out a particular function, it does not always set the function in any context — a newcomer to word processing may be able to work out *how* to perform a certain function, without knowing when to use it.

When reviewing the new software I used a PCW8256. Users working on the CPC6128 will find the manual that much more laborious because com-

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mands are always written for the PCW, with notes that explain the CPC equivalent. Appendices at the back of the manual are an indispensable addition, but the print quality of the appendices is poor and difficult to read.

Thankfully, the Tutor section occupies a discrete section — no need to wade through pages of examples in order to refresh your memory about specific commands. Supplied on disk is a tutor file which explains some of the basic editing functions.

Conclusion

A prior knowledge of word processing, I think, is crucial in order to make the most, or anything at all, of Protext.

The manual itself assumes at least a basic working knowledge of word processing, although at times it is quite inconsistent — it explains, for example, what word-wrap is, but not what a data disk is, or why or how to make one. Like Locoscript, the Start of Day disk has the software information on it, and therefore has very little free disk space.

A new user could quite easily fall into the trap of working from no other than the Start of Day disk — and with only 24k left once the Protext software has been stored, a beginner could soon become unstuck! I stumbled across the right method of loading and using a data disk only by trial and error — having studied the manual's chapter headings, and eventually the manual itself at length — to no avail. The manual also neglects to include basic knowledge about when it is safe to remove disks from the drives, or when to turn off the machine — obvious points, and essential ones for a first-time user.

The ideal user of Protext is someone who has a knowledge of Locoscript as well as other word processing packages. Even someone who has never used Locoscript, but who has worked on other packages, would be better off than the user familiar with Locoscript but with no other knowledge of word processing. The latter, with little support from what is essentially an unsympathetic manual, would find Protext daunting and difficult to come to grips with.

I would recommend to a potential Amstrad buyer who is contemplating also using Protex that both are bought at the same time, and that Protext, rather than Locoscript software, is used from the beginning but in conjunction with the Locoscript manual. This is rather a lot of information to absorb at once but without Locoscript, Protext will not make much sense. Yet, once mastered, Protext makes Locoscript seem like a typewriter. Having used it even briefly, a return to Locoscript feels like a return to the old manual portable.

For users with office requirements, and those, like myself, who regularly work with long documents, Protext is the solution to all Locoscript's drawbacks. Although it is not free of its own hitches — primarily an unsupportive manual — its additional spelling check and mail-merging functions make it worth the extra outlay.

END

Protext is available from ISD on (03) 222 2288.

SCREENTEST

Able One

Cheap, fully integrated packages seem to be the order of the day for novice or budget conscious buyers. Kester Cranswick gives Able One the once over.

We all recall the furore which greeted the first integrated software packages. Pay $1000 or more and you could get a single package that incorporated a word processor, spreadsheet, database, communications and possibly a graphics component. Such packages were ideal for the novice user who was short on a few dollars and could not afford to buy a suite of full-featured packages. They were ideal, too, for the executive who wanted to avoid the hassle of swapping disks to change applications and who did not need the power of single purpose applications.

But there were criticisms. The integrated software offered modules that were simplistic in their approach, and lacked the features of the custom applications.

There were two solutions. Firstly, go the custom application route and spend lots of money getting powerful programs which you might eventually grow into. Secondly, get integrated software down to a price that reflected the relative unsophistication of the genre.

In February *APC* we looked at a package called Ability, a $318 package that offered modest power at a modest price. It was heartily recommended. It is not alone in the market, and this time it is the turn of Able One.

Able One is also from the US, being developed by a company called International Inc. The package includes word processing, spreadsheet, database, communications and graphs modules. It also has the unusual, but desirable feature of being multi-tasking. It's priced at an affordable $300 and distributed by the Sydney-based Able.

For that money you get two disks, an instruction manual and a hard plastic case. You'll need a PC or compatible with 512k memory and two disk drives.

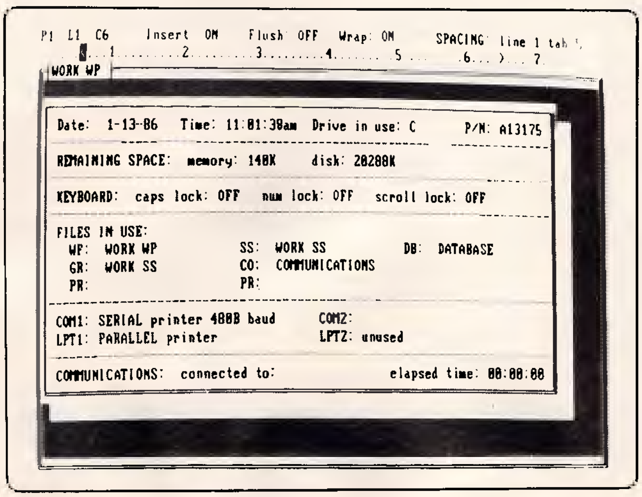

Fig 1: Pressing F10 activates the status window which shows the date and time, time elapsed since Able One was started, drive in use, disk and RAM remaining, files in use, status of caps lock, num lock and scroll lock keys, as well as the port configurations.

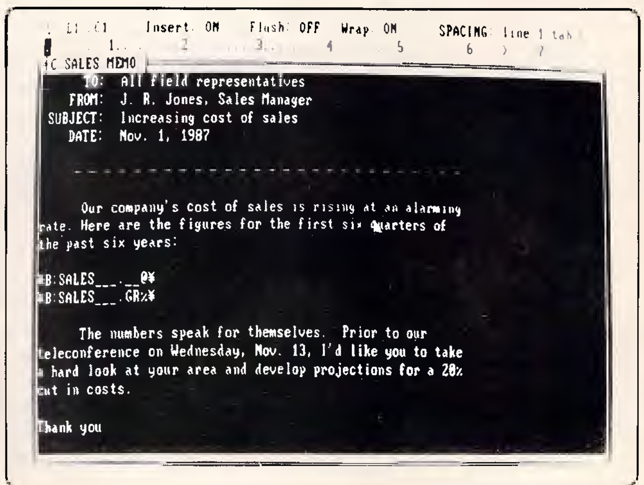

Fig 2: Above the word processing window are two information lines. The first shows the page, column and line locations of the cursor. Then there are indications of whether insert, justification and wordwrap are on or off, plus line spacing and tab settings.

A colour monitor with graphics card would not be missed either.

Getting started

Typing ABLE-1 at an MS-DOS prompt loads the program. The process takes about 40 seconds. After a simple opening program identification, you are presented with a list of possible functions. From the top, the list looks like this: word processing, spreadsheet, database, communications, graphs, backup, restore, utilities, quit and help. All modules are available, regardless of your system configuration.

There is also a window at the top of the screen that reads 'May I help you customer?' That's not very personal, so the first thing to do is to take advantage of the customisation procedure. Type 'name' followed by your name, and your name appears instead of 'customer'. Type 'greeting' followed by a short message, and that message will replace 'May I help you,'.

Colour is limited to the background, command line and task menu. This colour can be changed from the default blue, by entering 'color' and the color by name on the command line. But this will change the background colour only. Entering a number from 00 to 99 after 'color' gives a full range of background and foreground colour options, complete with flashing and inverse video. Colour is used in only a few of the modules, chiefly the spreadsheet.

The command line also features a primitive, English interface. With a dictionary of 19 words, Able One can be told to start a task with commands such as 'talk' (communications), 'memo' (wp), 'print' and 'help'. It's a bit of a gimmick, but who said Americans don't go for gimmicks.

This task window can be called from any task with the F7 key. In fact, the function keys are what give Able One much of its versatility.

F1 is the usual key for help. A context-sensitive help screen appears on screen, the text depending on the task. Each section gives a reference to the manual, but it is possible to figure out what's going on without the manual. You can also edit any help files, with the word processor.

F2 brings up a simple one-line calculator giving add, multiply, subtract and divide functions. Numbers are displayed as keyed in; Return gives the result.

In all tasks, F3 is the save file option. The existing file name is given, or a default name if the file is new. Accept or change the name, press Enter, the task is suspended as the file is saved, and then it's back to work again.

To print a file, any file, from within any application, press the F4 key. Two files can be printed separately, and as background to another task, but more of that later. More of the communications module, accessed by a press of the F5 key, later too.

From the tasks menu, the F6 key is most likely to be used, as it displays a list of files on the current drive, against a coloured background. Selecting a file with the cursor opens that file and the application associated with it. If you are already in an application, you will be prompted to save the current file before proceeding. Pressing the F7 key brings up the opening tasks menu. You might use this to start a new file in a task, though you'll find F8 is a more useful key. It brings up a coloured list of windows that have been opened.

> *'As with other tasks, the spreadsheet has a link feature, so data from other files can be referenced by a cell.'*

There will always be four windows in the list, default files for word processor, spreadsheet, database and communications. In addition, there will be windows for any other files active. Selecting the relevant window brings it to the foreground. If it is less than full screen in size, and windows are easily resized, other windows will still be visible in the background.

In all tasks, F9 is the options menu, the options depending on what application is being used. The options overflow the window space, so cursor keys are used to move up and down the list.

Finally, F10 brings up a status screen, again on a coloured background. It shows the date and time, time elapsed since Able One was started, drive in use, disk and RAM space remaining, files in use, status of caps lock, num lock and scroll lock keys, as well as the port configurations.

Word processing

Word processing is the key component of Able One, as besides being the means of writing documents like this, it also provides the output for database reports, can incorporate spreadsheet figures, charts and create documents to be sent electronically.

It is stacked full of features, at least on paper. The most exciting attraction is a spelling checker, something that certainly gives Able One an edge over arch-rival Ability.

Other features include a good range of formatting commands, the ability to print out two files, while working on a third, a mail merge facility, cut and paste commands and the ability to store deleted text in a linked file.

When a word processing file is started, a screen-size window is opened. This can be resized, a corner at a time and with the options menu. The name of the file is shown at the top of the window area.

Above that are two information lines. The first shows the page, column and line locations of the cursor. Then there are indications of whether insert, justification and wordwrap are on or off, plus line spacing and tab settings.

Below is a ruler, with margins, tabs and cursor positions indicated. Margins are also shown in the word processing window as block text characters from the edge of the text area to the edge of the window. A thick line indicates a page break. Changes to any setting are done using the options menu, selected with F9. If you are making many format changes, having to call up the options menu and page through the selections each time is trying on the patience. There are no function keys that, for instance, perform a 'go to' or 'find' operation.

Moving within a document can be by the cursor or tab keys, or a find command. Cursor keys move the cursor a character at a time in all four directions. Pg Up and Pg Dn have their stated effects; Home and End go to top and bottom of the document respectively. Ctrl and left or right arrow keys move the cursor a word at a time.

The Find option accepts a string of up to 39 characters and does a non-case specific or exact match on those characters. When a match is found, the option to continue the search is given.

The replace option is similar, though you have to enter a replacement string, again of up to 39 characters, and are given the option of a global replace, or a user verified replace of each matched string.

Able One is able to keep up with rapid typing except at those times when it saves a block of text to disk. In that case, display pauses for a few seconds, catching up when data storage is complete. It is something you learn to live with.

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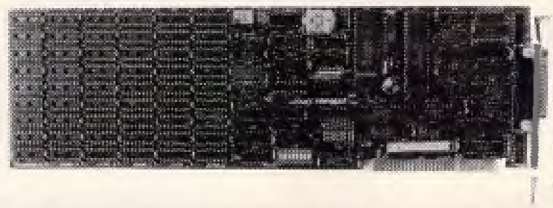

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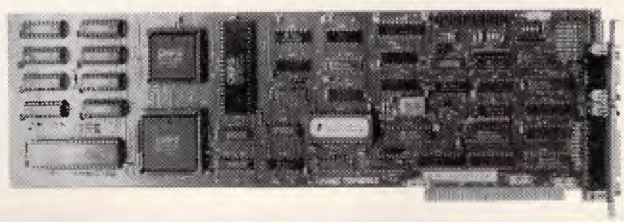

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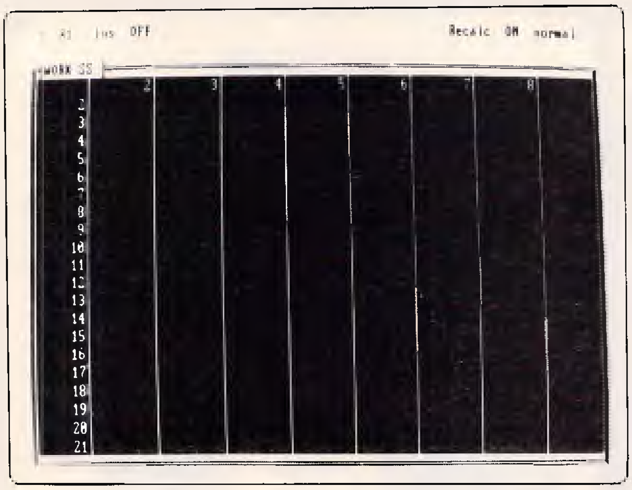


Fig 3: With a 10,000 cell range, the Able One spreadsheet is again an impressive facility. It has charting, colour presentation, iterative calculation, sorting and much more.

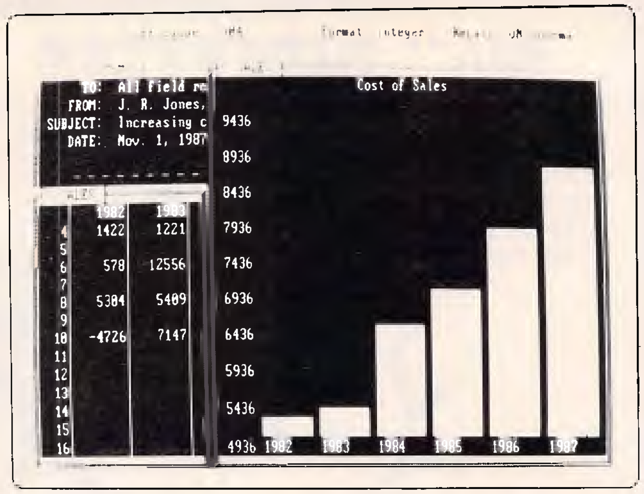


Fig 4: One of the best features of Able One is its ability to run several tasks at once. Switching isn't instantaneous though, but it does enable changes in one file to be immediately reflected in linked files.

ward once you get the hang of it. The backspace key removes one character at a time. Pressing the Del key gets you into a delete mode. The cursor is moved from its present location to the start or the end of the text block to be deleted.

Press the Enter key and the text is saved to disk in a temporary file, and then removed from the screen. Another option will undelete text. When the work file is subsequently saved, a prompt asks if the deleted text should be saved. This is not a feature found on the majority of word processors, and could come in handy for form documents that are often changed.

The procedure for moving or copying blocks of text is similar, with a block being outlined, and the target location selected with the cursor. With copy, however, you can move in text or data from another file, be it spreadsheet, database or another document.

To insert the whole of another document into a word processed file, the attach option is used. The attached text does not appear on the document screen. Rather, positioning the cursor on the file name that does appear, and pressing Enter displays the relevant data.

What this means is that a file can be attached, and when the document is printed, the latest version of that file is incorporated.

Graphs as well as data can be attached to a document. They are not visible on the word processing screen when the Enter key is pressed.

Formatting controls include margin resetting, justified or ragged right text, any amount of line spacing or tab setting, and bold, underlined, superscript or subscript. Two other printer enhancements can be set as well, if you know the relevant ASCII codes.

There is a worrying display problem encountered at times when you use the print format or delete commands. For instance, bold text is meant to appear as white on the grey 'paper', underlined text as purple and so on. What can happen is that the display gets confused, so that normal text appears white, or on-screen line spacing is upset. Once this happens, you really don't know how your document is formatted, and there seems no cure for this, other than quitting the application.

Other options allow a file to be saved as text, for use in other word processors, for the temporary deleted text file to be removed and for lengthy headers and footers to be inserted and displayed. Reformatting is done a paragraph at a time. There is no global reformat command.

Macros can be created easily, and assigned an Alt key. The macros can't be set up to perform option commands though, and are limited to actions that are keyed in. That's a pity, as it would be nice to have a macro that automatically reformats.

The spell checker sounds useful. It checks by paragraph or globally, marking words not in the dictionary. A further option goes through the marked words for correction and optional addition to the dictionary. However, spell checking an entire document is incredibly slow. Half this document took at least five minutes!

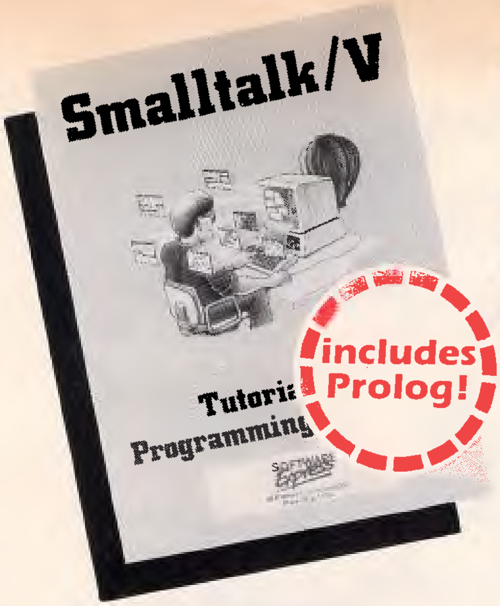
For printing, there are some good features. With the F4 key, two documents can be printed in the background, if two printers are attached. Page numbers on paper are optional, and there is a single sheet option. Page width and length settings can be altered and partial documents printed.

To print labels, database reports or do a mail merge, there must be a database. So, let's examine that.

Database

Able One's database is a suprisingly sophisticated affair, featuring relational capabilities, data verification and usage of the word processor as a report generator. You'll need to know a little about database construction to use it, but with help on hand and a little forethought, you'll get by.

First off, work out the fields needed, and their length. Able One sets up fields as alphanumeric, numeric or integer, with each field optionally indexed as a primary or secondary field or unique, so the value can be entered only once. Fields can also be calulated and/or linked to others.



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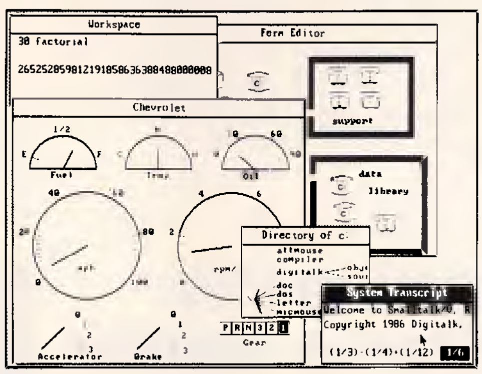
Smalltalk/V's incremental style of program development lets you edit and install small code fragments without lengthy compile and link sessions, building a program piece by piece in whatever order suits you and seeing the results immediately. You can experiment with bits and pieces of the program long before it is complete, exploring ideas, structures, and algorithms as the program takes form.

Smalltalk/V gives you access to the most advanced tools of modern computing: bit-mapped graphics, a point-and-click user interface (with or without mouse), multiple windows, a source-level debugger, and much more. It even includes Prolog! Smalltalk/V organizes these tools into an easily understood hierarchy of classes, extensively annotated, with source code included and easily accesible on-line. You can edit and change any part of Smalltalk/V, to make it fit your needs exactly. With Smalltalk/V, your computer becomes what it was intended to be, a truly personal tool for your mind.



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There is also a master category, used for setting up what the software developers optimistically dub a relational database. The master tag is supported by a transaction record tag. This means that a master file can reference several related entries in another database. It adds a degree of sophistication to the database, but if you are really needing this sort of power, a dedicated database package should be considered.

Data entry templates are drawn up by entering field names and descriptions on screen. Templates can be modified at a later stage. You can also set up a template to allow only certain values to be input in a field, such as a range of account numbers. Templates can be duplicated too.

For calculated fields, numeric values from another database or a spreadsheet can be used. With the windows facility, the source file is called up and the cell or field selected. By the same means, fields can be linked to data outside the database. Whole files can also be attached to a database, with their presence indicated by a marker.

Selected files from another database can be copied into a primary database, ordered according to indices if necessary, and with the opportunity to verify a record before it is added. Text files can also be included, provided they meet field specifications. Conversely, a database can be converted to a text file for word processing, again with ordered, unordered or query options.

For searching, the usual wildcards can be used. Boolean operators plus and/or relationships can be specified. To browse through files, enter no value for the search criteria.

Other facilities include a count of records that match search criteria, and a summing facility that adds numeric values in a selected range of fields. It's all good, useful stuff, belying the expected usefulness of integrated software.

To print a report, a text file must be set up with the word processor. With the report designed, fields are attached to the document, and given any length necessary. A range for an indexed field is specified, and the report can then be printed. Any database updates will be reflected in the report. It's a tedious setting up procedure, but once mastered, quite straightforward.

Spreadsheet

With a 10,000 cell range, the Able One spreadsheet is again an impressive facility. It has charting, colour presentation, iterative calculation, sorting and much more.

Cells can be referenced by labels, derived from column and row headings, absolute or relative co-ordinates or given a name that can be used in formulae.

Within formulae, ranges can be specified, and there is the usual range of mathematical and Boolean operators.

Special functions include those to add a column or row, four statistical functions, mathematical functions and circular referencing. With this last function, a cell value that must be calculated based on another value, but that forms part of that total, can be calculated iteratively, with the number of iterations and the error range being specified. Few spreadsheets of any complexity have this.

As with other tasks, the spreadsheet has a link feature, so data from other files can be referenced by a cell. There is a recalculate feature that can be off or on. The status line indicates the status of recalculation, as well as cell formats and values.

'because Able One is a multi-tasking program, communications can be run as a background to any other task. . .'

With a colour monitor, ranges of cells can be highlighted in a colour selected from the options menu. And, to make a chart is simplicity itself. We'll look at charts next, but suffice to say that choosing a chart option, highlighting a range of cells and pushing the Enter key produces an on-screen chart in a few seconds.

Other features include cell protection, column and row adding or deletion, optional row and column heading display and cell display being centred or justified left or right.

Finally, spreadsheet data can be incorporated into a text document, again by linking the file. It all adds up to a powerful, sophisticated spreadsheet facility.

Graphs

There are three chart options — bar, pie and scatter. Choose the presentation format, select a cell range, verify minimum and maximum ranges, margins and so on. Seconds later, the chart is displayed, and can be saved for printing on a printer or plotter.

The bar chart allows 50 numbers to be charted. When displayed, the spreadsheet is still visible, and altering any values in the spreadsheet instantly updates the chart. The chart remains visible until the bar chart option is reselected.

To get a pie chart, you need a graphics card. Up to 30 values can be plotted, and the chart can be exploded if wanted. You can also choose from a small or large chart, with optional naming of slices.

Scatter charts also require a graphics card. As with pie charts, a scatter chart takes the full display, and can't be updated in the way a bar chart can. It will cope with up to 500 values, in line or point format, and with optional axis headings. Minimum, maximum and axis scale values can be altered from the values suggested by Able One, and there are two chart sizes.

Communications

Though the communications module is available as a task from the opening menu, it can be accessed from any module by pressing the F5 key. Alternatively, any number can be dialled from within another task, using the 'Dial' facility in every option menu. And, because Able One is a multi-tasking program, communications can be run as a background to any other task, with F5 able to display the communications window in a trice.

The only sort of communications that can't be done with Able One are those for Viewdata services such as Viatel. With the growing popularity of such services, it should be an area that integrated software addresses.

Default communications parameters are for a 1200 baud service. Changing defaults is done using the options menu. It's rather tedious as with each parameter change, the options menu disappears, has to be called up and the cursor moved down to the relevant option.

Parameters cover a reasonable range, with baud rates from 75 to 9600 baud, full, half and no duplex and a choice of two serial and four parallel ports.

The options under the remote device are for Hayes, Datec smart modems, manual modems, PC to PC, plus HP7475 plotter (the comms port is used to drive a plotter) and Novation (answers on a postcard, please). The data transfer protocol choices are Xon/Xoff and CTS/RTS.

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Using the communications module springs no suprises. Incoming text is stored as a text file, and can be used by any of the other Able One modules. The built-in macro facility lets you remember a sequence of commands, so logging onto a frequently used service can be done with a single command. A five second pause can be built into the macro and Able One automatically redials a number until it gets an answer.

Options in the module allow the display of incoming text to be turned off, and incoming hex data to be converted to ASCII or vice versa.

An answer option sets up Able One to respond to an incoming data call, either as a foreground or background task. In the former case, the remote computer takes control of yours. For a background answer facility, select 'answer' from the active module's option menu. When an incoming call is detected, a message appears at the top of the screen, and you press F5 to get into comms.

Multi-tasking

One of the best features of Able One is its ability to run several tasks at once. Switching isn't instantaneous though, but it does enable changes in one file to be immediately reflected in linked files.

Able One achieves what it does by storing all applications in RAM. When a window is called to the foreground, relevant data is called from disk. Data is also written to disk at intervals. Changing to another task involves saving data to disk, reading the new file and getting on with it. With large files, this can be time consuming, but the benefits are worth the hassle.

A niggling problem is that there is no option not to save a file, meaning that you'll have to regularly purge disks of redundant or unwanted files.

With all the possible tasks, files and windows, plus the ever-present options, it is not difficult to get confused about what file you are working on. Fortunately, using the Esc key will undo commands in reverse order, so if you get totally lost, just work back to the opening screen. I managed to hang the system a couple of times, so it is not foolproof. Frequent saving is the order of the day.

To prevent unauthorised access to private files, and/or all fieldsa password can be assigned . A master password lets a user see all passwords assigned to all files. While this is not a high degree of security, it is enough to deter the inquisitive busybodies.

Documentation

With the program you get a 280 page paperback manual and a loose sheet dealing with changing drive designations and using sub-directories. It assumes no computer knowledge on the part of the user and has introductory chapters based on sample files supplied on the master disks. Each module is then covered in detail, followed by a section on customising menus and a brief explanation of the options available in each module. There's an ASCII chart and a glossary of terms too, with the manual concluded by an index. To make the most of Able One, you'll need to study the manual.

Conclusion

For $300, Able One is an absolute bargain. It has the right range of modules, and their sophistication makes a mockery of the price.

The ability to multi-task and link data is excellent. To be fair, there are times when you feel that the program is not as robust as it should be, but considering all that is crammed in, it is a miracle it works at all.

It may not look as pretty as dedicated packages, and some tasks need a little too much keyboard work, but given the price, Able One is a welcome addition to the PC software ranks. If you need one piece of software to do a multitude of tasks, do give Able One the once over.

END

Able One costs $300 and is available from Able on (02) 817 4129.

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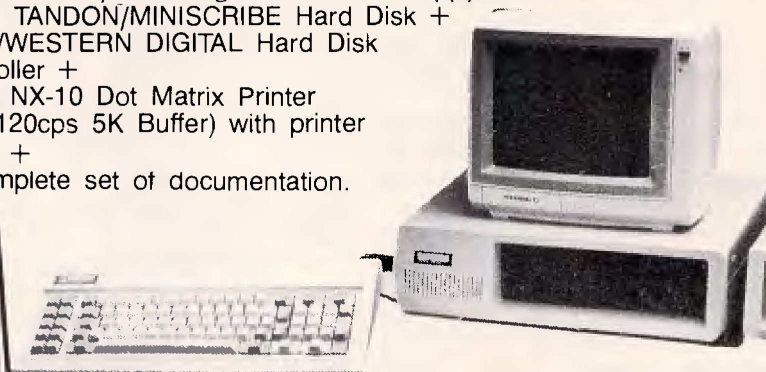

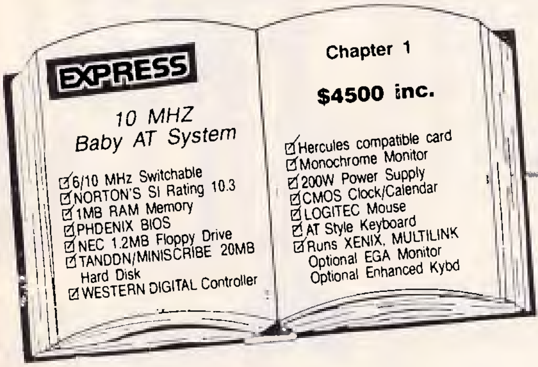

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Modem mix-up

This month Steve Withers presents his regular bulletin board update and has a sorry story to tell.

A couple of months ago, I invited you to report problems with supposedly compatible modems failing to work together. This prompted Sandy Barrie to send me a horror story of a slightly different kind.

Sandy owns a 512k Macintosh, and wanted to start using Viatel. After reading the adverts and brochures he settled on the NetComm 3+12 modem, having previously bought NetComm's MacVideotex software. To be on the safe side, he checked with the agent for NetComm in Queensland who could see no reason why it wouldn't work.

Sandy bought the 3+12, but failed to get it to work. He telephoned NetComm and was told to change the setting of a DIP switch on the modem. That didn't get things working, so he got back on the phone. This time he was assured that he needed the new version 1.2 software.

At this point he started to worry. He had sent the software registration form to NetComm by certified mail back in November, along with a letter asking for more information about certain features of the software, but had received no reply.

He couldn't get version 1.2 of MacVideotex in Brisbane, so it was time to ring NetComm again. NetComm changed its tune, explaining to Sandy that the 3+12 (as opposed to the 3+12 Auto) was not compatible with the Macintosh and MacVideotex because the Mac couldn't use split baud rates.

He wasn't happy with this explanation, so he checked with Apple. Apple's story was that the Mac can use any combination of baud rates, providing thesoftware configures the port correctly.

Sandy is a fairly typical Mac owner: 'I love the Mac for the reason that I don't normally have to know what goes on inside . . . it is great that there are people who do [but] I simply like things that plug into the computer, and they have so far all worked.' Fortunately, Imagineering explained the problem in terms he could understand. MacVideotex uses 1200 baud in both directions, while the 3+12 requires 1200/75.

What was to be done? NetComm would upgrade the 3+12 to something close to (but not exactly the same as) a 3+12 Auto, but the cost was about 25 per cent higher than the price stated in the documentation accompanying the modem. Sandy was beginning to ask the right questions: 'does it need special software, or will MacVideotex 1.0 work?' The answer was that he would need version 2.0. Version 2? NetComm hadn't even informed Sandy (as a registered owner) of version 1.2.

The cost of the hardware upgrade (over $250) was more than Sandy was prepared to pay, and to make matters worse he was expected to pay a further $50 for the software upgrade. After all, the main reason for choosing the 3+12 over the 3+12 Auto was the lower price of the manual model.

So what are Sandy's specific complaints? Concerning NetComm: it 'implied that the modem is compatible with all PCs (in my vocabulary that tends to mean personal computers, and I think that any Apple dealer would agree that the Mac is definitely a PC).' Concerning Imagineering: 'In Imagineering's 'Macintosh Product' catalogue, there is a colour photograph of some modems under the story on the NetComm modems and communications programs . . . on the top of the pile (is) the 3+12.'

I certainly agree about the meaning of PC — you're reading *APC* aren't you? I haven't seen the Imagineering catalogue so I can't comment, but Sandy tells me that Imagineering's reaction to his complaint was 'it's unfortunate about the photo.'

Things should turn out alright for Sandy. After many phone calls, Imagineering has arranged for him to return the modem to the dealer for full credit against the purchase of a 3+12 Auto. Sandy will end up paying much more than he planned, but he is hopeful that everything will come right in the end.

What can be learned from this unfortunate tale? Taking it at face value, Sandy behaved sensibly. He did his research before choosing a modem, and checked with the manufacturer's agent before buying his chosen model. Perhaps he should have become suspicious when the agent 'could see no reason why it would not work', rather than assuring him that it would.

If you don't know anyone who is already using the combination of products (computer, software, and modem) you propse to buy, and you can't find any specific information in any of the magazines, there isn't much you can do apart from taking the dealer's word that the components will work together. You are fairly safe if the modem and software are sold as a package deal for your computer. If not, you could ask for a demonstration, but this might mean taking your computer and software to the shop; if you are looking at a cheaper modem the dealer might feel it is all too much trouble for the amount of profit derived from the sale. In the absence of information

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— Light pen interface

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9 by 14 character matrix
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— Graphics mode:
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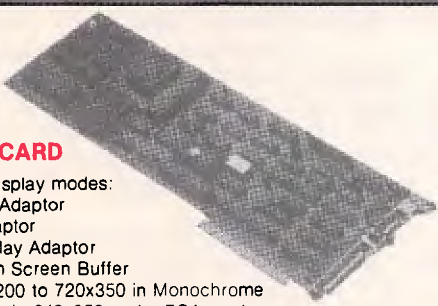
— A parallel printer port



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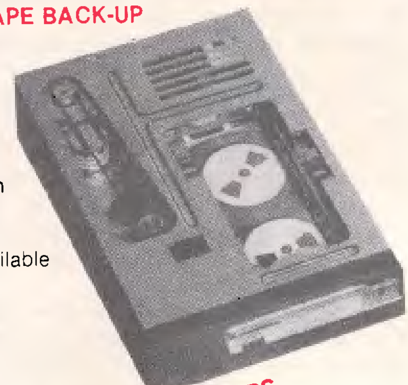

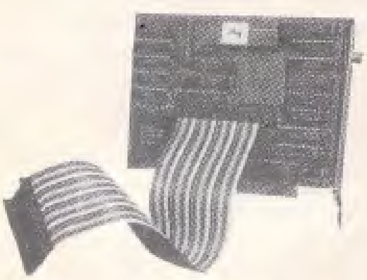

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from an existing user, your chances of success are probably highest when the dealer sells the computer, modem, and software that you intend to use.

New videotex systems

Two new videotex services have recently been announced, each targetted at a particular group of users. Bridge Data is reported to be setting up a competitor to Viatel's Moneywatch service, offering real-time financial data from Australia and overseas, plus charting, portfolio management, telebroking, and other financial services. Access to the service will be via dial-up lines in Melbourne, Sydney, and Perth, or via Austpac in other areas. A Viatel gateway is also planned.

Although Telgraf is setting up a general interest videotex database, the service is currently being aimed at the physically handicapped. While Telgraf is currently running on a network of sixteen PCs, the company claims it is about to install a minicomputer. Telgraf's services — existing or planned — include the news and communications facilities found on most public-access videotex systems, tax facts and figures, an encyclopedia and dictionary, a free database for the disabled, and extensive teleshopping facilities including home delivery of grocery items at prices well below those found in supermarkets. That could just be enough to allow the company to reach its goal of being the largest videotex database in the world, although not everyone is taking the company seriously.

Buy Australian?

Telecom has been given a hard time in the trade weeklies following a decision to purchase foreign network access controllers for its new EFT (electronic funds transfer) network. The reason for the fuss was that Telecom was offered a proven, Australian product that had achieved considerable overseas success, and yet foreign equipment was selected.

More red tape?

Telecom has recently written to the operators of many bulletin boards telling them that they need Telecom approval. It appears that Telecom regards a BBS as being an example of 'third party switching'. The person who brought the letter to my attention is one of Australia's pioneer sysops, and before he put his BBS on-line he spent a lot of time and effort trying to find out from Telecom if any approval was needed. He was referred from one office to another, but no-one seemed to understand the concept of a bulletin board. Eventually, he gave up and started operation. Five years later, Telecom has decided that approval is necessary.

The letter also states: 'Telecom regards Bulletin Board Services as generally operating in a commercial environment and as such the access telephone line is classified as a 'business service' and will therefore attract the appropriate rental charge.' This is so clearly ridiculous that I wasn't sure whether I should laugh or cry. A few bulletin boards are run along the lines of a business, and some are provided by companies as a promotional tool. The vast majority are run by individuals or clubs on an obviously non-commercial basis. There can be no possible justification for these people being asked to pay business rates for their phone lines.

Perhaps I'm getting paranoid, but it worries me that this letter appeared a few weeks after reports that all data calls are to be charged on a timed basis. It is almost as if Telecom is trying to make BBS sysops concede that they are offering a business service so that it can justify placing bulletin boards in the same category as truly commercial operations for charging purposes.

Telecom offers a pretty good telephone service, but its officers seem to have some strange ideas about data communications.

System news

A good selection of new (or previously unlisted) systems appears this month, thanks to Larry Lewis, Graeme Nichols, Brendan Pratt, and Kit.

Brendan also mentioned that his system (SVI) is the only board in Australia to include a specialist section on aquaculture. If you make a living raising shrimps or other marine life, or simply have an interest in such things, why not take a look? In addition, Brendan pointed out that he expects SVI to stay on-line for much longer than previous Gold Coast-based systems have managed.

New systems

NSW

Club Mac (02) 521 1359. MV. R King. 24hrs daily. V21, V22, V22bis, V23.
Datacom (02) 643 1220. MV. James Butler.
Dingo's Den (02) 888 2203. MV. David Harvey. V21, V22, V23. FidoNet.
Eagle's Nest (02) 451 0535. MV. Philip Dean. 24 hours daily.
Idiom (02) 438 4060. MV. Stephen Beeby. 24 hours daily. V22, V22bis.
Laser Line (02) 997 6820. MV. Ward Britton. 24 hours daily. V21, V22, V22bis, V23.
Micro Mart C Users' (02) 560 3607. MV. Rick Polito. 24 hours daily. V21, V22, V22bis, V23.
Comm-Link (043) 41 3135. MV. Jeff Campbell. 24 hours daily.

ACT

Gateway (062) 47 4820. P. James Collins. 24 hours daily. V21, V22, V23.

Vic

Custom Programming (03) 848 3331. P. Alan.Williamson. 24 hours daily.
Devil's Playground (03) 553 2728. Nick Todd. 24 hours daily.
Eastcom (03) 288 0775. P. Maurice Halkier.
Electronic Cross-Over (03) 367 5816. Stephen Paddon. 24 hours daily.
Inner Sanctum (03) 233 8346. MV. Robert Swaab. 7.30pm-7.30am weekdays, 24 hours weekends.
Mike's Bullboard (03) 459 6439. Mike Lewis. 24 hours daily.
Osborne Australia (03) 529 3519. MV. Craig Orr.
Supermicros (03) 799 2001. Richard Tolhurst. 24 hours daily. Also on (03) 799 2041 for V21, V22, V23.
Telegraph Road 903) 743 6173. MV. Kit. 24 hours daily.
Ten to One Amiga (03) 762 7961. Mike Beckett. 24 hours daily.
Ultimate C64 (03) 735 5551. Mike Kabiolke. 24 hours daily. V21, V22, V22bis, V23.
Zoist (03) 467 2871. Bob Fletcher. 24 hours daily.
Omega (052) 22 1670. Mark Gregson. 7pm-2am daily.

Qld

Focus (07) 285 5814. MV. 24 hours daily. V21, V23. User Works Node 6.
Software 80 (07) 369 7103. MV. Tony Melius. 7.30pm-8am weekdays, 2.30pm Saturday-8am Monday. V21, V23.

SA

Adelaide Microbee (08) 212 6569. Ron Carson and Mark Hammond. 6pm-8am

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WA

Student Access Message Service (09) 321 9721. MV. Peter Walton and John Bramley.

Updates

NSW

Fido Australia (02) 959 3712. B and L Gatenby, R Morgan. 24 hours daily. V21, V22, V22bis. FidoNet.
InterTan (02) 625 8071. MV. 24 hours daily. Previously listed as Tandy.
Software Connection (02) 451 2954. MV. Graeme Nichols. 24 hours daily. V21,V22,V22bis, V23. Previously listed as OS9 Connection.
Warringah (02) 977 0323. MV.Bryan Wilde. 24 hours daily. V21, V22, V23, Bell 103, Bell 212, FidoNet.
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ACT

ACT Amiga Users' Group (062) 59 1137. MV. Mike Hurst-Meyers. 24 hours daily. V21, V22, V23.
Comtel (062) 59 1244. MV. Warren Mason. 24 hours daily.
Professional Computer Users' Group (062)59 1244. MV. Alan Salmon. 24 hours daily. V21, V22, V22bis. FidoNet. Previously listed as SeaDog.

Vic

Sam's (03) 563 1117. P. Alan Hasler. 24 hours daily. V21, V22,V22bis, V23. FidoNet.

Qld

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Omen V (08) 332 4631. MV. Richard Siggs. 24 hours daily. Typographical error in phone number in January *APC*.
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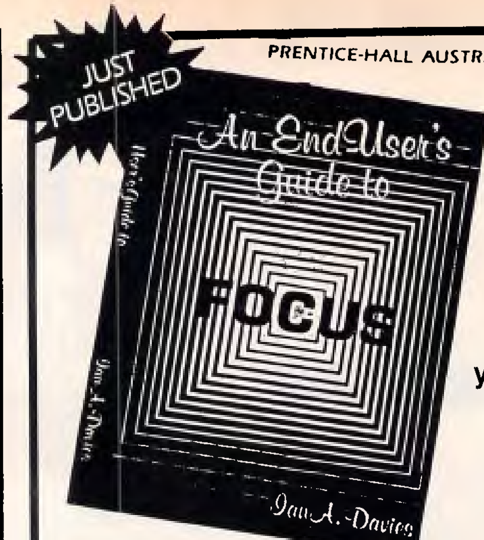

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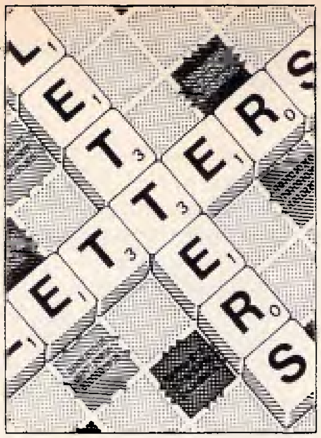

This is your chance to air your views — send your letters or contact us via Microtex on Telecom's Viatel, page 666. The address to write to us is Australian Personal Computer, 2nd Floor, 215 Clarence Street, Sydney. 2000

Write and wrong

Yes, PC-Write is complex as well as flexible (review, *APC* March). The more functions you have, the more you have to learn. I don't see any way around it. Word processors written to make things simple for naive users and computerphobes just don't have much to offer the able computer enthusiast. Luckily there is no rule that all products must be aimed at the lowest common denominator.

You did miss some nice beginners' features in your review. There is no function key overlay because none is needed. Press Shift/F1 and you get a two-line function key Help at the top of the screen. Normally this shows the effect of pressing the function keys on their own, but when you press Shift, Alt or Ctrl the display switches to show the effect of the function keys pressed with the Shift, Alt or Ctrl keys as appropriate. But there's more.

I use PC-Write with an Amstrad PC1512, and can use the mouse not only for skating around in the text, but also for selecting functions. You press the right button to bring up a two-line function menu at the top of the screen, then scroll the whole set of functions through the menu and highlight the one you want by moving the mouse. Each function has a one-line help that appears under the menu as each is highlighted. Press the left button to select. Some functions bring up a sub-menu which works in the same way. No need to mess with mouse drivers — the Amstrad MS-DOS start-up disk takes care of it.

Mr Schifreen complains of the visibility of the font control characters (little faces, and so on). If he doesn't like them, he can turn them off. Just press ALT and the spacebar to toggle them on/off. The great thing is that you can see them if you want to. As for the colours of the text and background combinations used to display enhanced text, there are 26 possible fonts or enhancements — do you want them all to be displayed the same? No WYSIWYG word processor that I have seen can support that many options, and the options they do support don't always show on the screen as they will on paper. Unless your PC screen has italics and superscripts?

Furthermore, PC-Write can print accented, Greek and graphic characters (on a printer that has them) and it shows such characters on screen. If your printer won't do the IBM character set, accents can be printed by a second pass or by backspace overprinting. The printer definition file that PC-Write constructs for your printer when you make your work disk will set this up as appropriate, so you don't really have to mess with the configuration file.

I Davidson

Robert Schifreen replies: I quite agree with your opening statement — PC-Write is both complex and flexible. My opinion on this situation is that, while trying to be flexible, the package provides facilities which are aimed fairly and squarely at experienced computer users like ourselves, and not at someone in a non-computer industry who wants a word processor and not a program editor.

If you are someone who likes to use a mouse with a WP then fair enough, though personally I find it faster to keep my hands on the keyboard all the time.

The multiple-page help feature is far from complete. There are around 45 'pages' of help, each of which takes half a screen. How can a package as flexible and complex as this (your words) be summed up in such a short space?

While I am aware that the font characters can be turned off, the marker could be more understandable to the average human. Surely something like [Bld ON] says more than a red, smiling face?

Perhaps when the spelling checker can guess words correctly, a thesaurus has been added and the manual updated, I will look again at the program.

Incidentally, did you know that when you shell from PC-Write to DOS you can cut screens from any program and paste them into PC-Write? I'll leave you toread the manual to find out how.

An unbiased view

Among all the hype surrounding its launch, Guy Kewney's review of the Amstrad PC1512 (*APC*, November 1986) appeared to provide objective evidence that this really is the 'perfect PC clone'.

For those of us who've actually managed to get our hands on one, however, it seemed strange that he had no criticisms of the PC1512's extremely 'lightweight' keyboard, an important point for any computer being considered for serious business use. Nor did Kewney acknowledge that the choice in screens, between paper white and low-resolution colour, makes the PC1512 less than ideal for business applications.

LETTERS

The increasing number of applications which rely on high-performance graphics means that many of us do already need EGAs; while those who prefer a green screen will not be able to simply plug one in, as Kewney suggests, since the PC1512's monitor is non-standard.

Yet for those of us who read the trade press, none of this is so surprising: Kewney has been employed by Amstrad 'to ensure the success of the PC1512 launch'. Nice one.

Now, how about a *really* objective review.

JR Gilliatt

Defending the Amstrad PC

P Herzlich ('Letters', *APC*, December 1986) really should get his facts straight when he joins the Amstrad bashers.

Lets take each of the 'drawbacks' in turn. Firstly, the keyboard and screen. Yes, keyboard appraisal is subjective — he disliked the Amstrad's, I find it good; as for its durability ... they said the Amstrad PCW8256 keyboard (which is inferior to the PC's) wouldn't last — my department has 27 PCWs and not a keyboard fault in sight!

As for the screen resolution, who's kidding who? The Amstrad mono screen is not the best I've used but it's perfectly legible, and anyone who says otherwise is playing one-upmanship. I have used it for hours and have not had to visit an optician.

Secondly, compatibility. Here is a list of software, bought for the Olivetti M24, that I have run successfully on the Amstrad PC without modification: WordStar, WordStar 2000, Word V2.1, Word V3.0, GEM Write,

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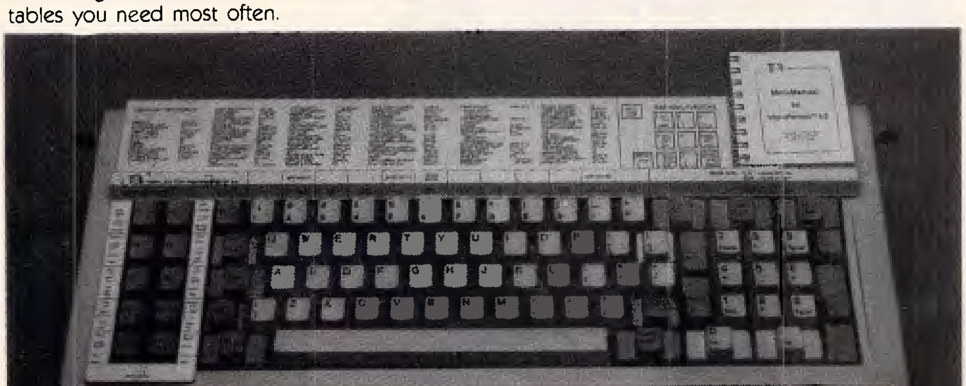

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dBaseII, dBaseIII, dBaseIII+, Lotus 1-2-3 V2.0, SuperCalc 3, GEM Draw, GEM Word Chart, Super Project Plus, SideKick, Norton Utilities and IBM diagnostics. ChitChat required the device driver (in the CONFIG, SYS file) to be changed from 'DEVICE=RAMDRIVE.SYS' to 'DEVICE=ANSI.SYS', and ran perfectly thereafter. COPYIIPC and COPYWRIT (both programs to copy protected software) would not run. The parallel and serial interfaces are IBM standards. Not bad, eh?

As for the RAM upgrade to 640k, I would hazard a guess that Amstrad is simply being over-cautious in insisting that machines are returned to the dealer for this operation. The PCB has the spare sockets for the extra RAM — *I* wouldn't mind giving it a go. Anyway, how many users would attempt such an exercise? Most would turn to their dealer no matter which machine they had.

Thirdly, Mr Herzlich's statement that the Amstrad PC is a 'box' not a 'solution'. Sorry, the Amstrad is much more of a 'solution than similar machines that come with 128k, no monitor, an 8088 (4.77MHz) processor and one disk drive at a cost more than the 1512.

As for IBM's next move, who really knows? But to imply that the Amstrad PC will not be a mainstream machine in twelve months' time is naive. Are people going to stop using Lotus, dBase and Word during this time? Users have invested years in these products and are not going to be easily weaned off them. What is more likely is that the cosy cartel (Microsoft, Ashton-Tate, Lotus, IBM, Olivetti, Compaq *et al*) will wake up, reduce their apparently obscene profit levels, and start writing for the 80286 and 80386 machines in the unprotected mode. But this will take time and until then, 'Why buy any other PC?'

R Elliott

Monolithic monster

It was disappointing to note a sense of *fait accompli* in your article regarding Telecom charges (*APC,* February Communications) and the effect on computer communications.

The continuing frequent increase in charges imposed by this monolithic monster must be stopped. The apathy of the Australian subscriber has allowed the management of Telecom, which has no competition and does not wish to be answerable to anyone, to increase rates as it likes. The management enjoys salaries and conditions far above any other public servants in this country and I am sure does not pay for personal phone calls.

It is a complete waste of time discussing anything with Telecom; it can justify everything.

Subscribers *must* contact their Federal Members of Parliament (this being election year) and demand an independent inquiry into the charging policies of this monopoly.

As well, *APC* readers could now write to the Hon Barry Jones, the Minister appointed to look after the Prices Surveillance Authority, expressing their disgust at the cost of communication in this country. If Viatel users prefer to shut up now they will have to pay up soon, it is up to them.

M T O'Connor

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Many software packages provide nifty features which are only able to display their output on the screen or to the printer, but which would prove extraordinarily useful if routed to a file. Similarly, some users would find it useful to perform a quick 'print to disk' on one machine and physically transfer the diskette to another machine with a more suitable printer, thereby avoiding the heartache of LANs.

Last month's article featured a relatively simple-minded 'screen-dump to disk' facility activated by the normal Shift/PrtSc key combination. This month, we introduce a few more techniques required by full-fledged memory resident software and, through these, develop a general solution to printing to disk. The end result is a 512 byte program which redirects all parallel printer output to a disk file of your choosing.

The Entree

The first design decision is which vectors to hook into, and requires an understanding of how printer output flows through the system. Figure one shows the possible flow from top to bottom.

Notice that virtually duplicate paths exist for parallel printers and serial printers, the only common point being the DOS generic print device, PRN. PRN always refers to your system printer, no matter the type of printer or the port to which it is connected. By default, PRN feeds through to LPT1, but may be reassigned through the MODE command to LPT2 to LPT4, or COM1 to COM2.

The COM and LPT devices refer specifically to particular serial and parallel ports, essentially being conceptual front-ends for DOS functions 04 and 05, which can be called directly from programs using the INT 21 instruction previously discussed. Like most DOS functions, these two pass control and data through to a corresponding Bios call, INT 14 for serial and INT 17 for parallel. As discussed, Bios functions are all accessed under different interrupt numbers, rather than the DOS approach of utilising a single interrupt number and loading a function code into a register.

'Using DISK 17 is a great deal easier than reading about it .'

Finally, the Bios routines take care of directly driving with the communications or printer adaptor, knowing which port addresses they are connected to, and issuing the appropriate commands and data transfers to the controller chips.

From this structure, the obvious place to interpose a memory resident program would be at the very top of the call sequence. Sadly, however, different software products take different approaches to driving a printer. Very few start at the PRN level, even fewer at the LPT or COM levels. In fact, usually only home-grown software drives a printer through these mechanisms as very little control over error conditions is available to the programmer. Some products utilise DOS functions 04 and 05, but these functions also provide very little in the way of error handling.

The vast majority of commercial software uses the Bios routines, which provide full control of error handling and, in serial printers, allows the baud rate and word configuration to be set.

It is also possible for software products to bypass all of the operating system interfaces and manipulate the hardware directly. This is, however, almost unheard of for simple printer drivers. While just about everything bypasses the video output interfaces and goes direct to video memory, and while many communications products manipulate the UART most intimately, the designers are forced into these approaches by the inadequacy of the operating system interfaces provided. In comparison, printing is a relatively simple operation and the Bios routines provide all the necessary functionality. Software designers therefore utilise the standard interfaces.

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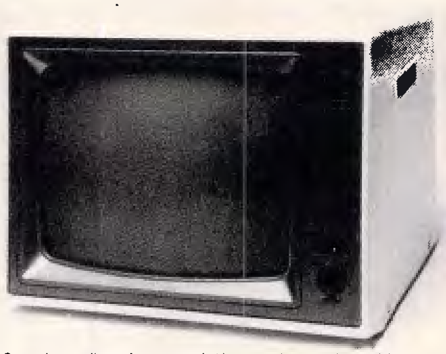

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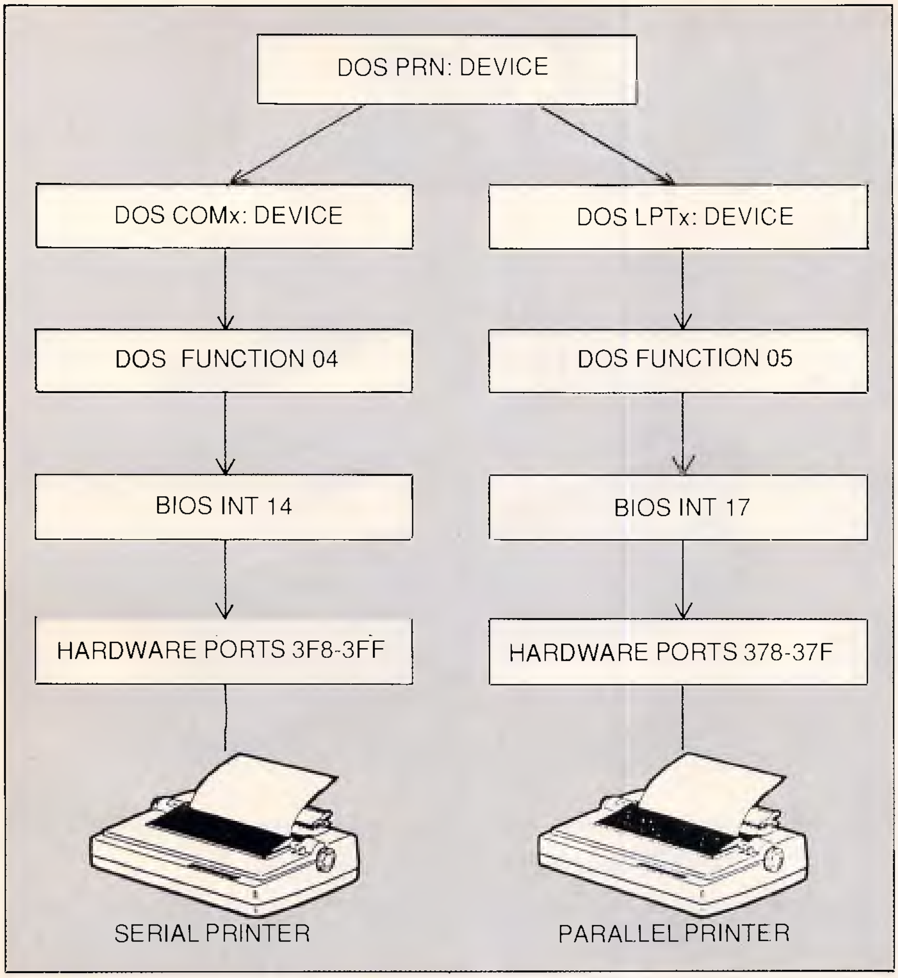

Figure 1: Conceptual flow of a printer output through the system

developers have little need to go directly to the hardware, and that there is virtually nothing that can be done if they do, we can therefore safely assume that interception at the hardware level is not necessary.

The obvious point of interception is the Bios level, as software which utilises the higher level interfaces must have its data eventually passed through the Bios anyway. Additional assumptions further simplify the task by removing the need to catch both INT 14 and INT 17 Bios calls. Almost all software provides the option to select either serial or parallel printers. Those which do support both are almost always dedicated to parallel printers, so we can safely assume that implementing the INT 17 parallel printer intercept will be sufficient for the majority of circumstances. This also means that there is little or no chance of interfering with communications applications.

The end result is a print redirector which reliably catches data from almost any software environment, even the DOS screen print (shift/PrtSc) and echo to printer (control/PrtSc) functions. Thus this program also performs the function of last months PRTDISK module, although PRTDISK is still useful for selectively catching only screen dump output.

The strategy

The next step is to decide which vectors need to be involved in the program. Clearly a new INT 17 handler is required which behaves exactly like the normal INT 17 Bios routine, but sends its output to disk rather than the printer.

Since INT 17 may be called from pretty much anywhere, including DOS, and since file I/O DOS calls cannot be made while DOS is active, the handler needs to check the DOS 'critical' or 'call in progress' flag discussed last month.

A buffer can be allocated dynamically to accumulate a reasonable amount of data before flushing to disk, and the INT 28 'DOS idle' vector can be used to ensure the buffer is fully flushed when the user is at DOS command level.

It must be realised that DOS may not be in a suitable state for the new INT 17 handler to issue DOS calls when a character is to be printed. This can be dealt with by allocating a buffer which is larger than the amount to be written to disk each time, and setting a 'threshold' beyond which the handler will try to write the buffer to disk, suppressing the attempt if DOS is not fit to be called. The buffer can then grow past the 'threshold', up to an overflow point, in the hope that DOS will soon be in a callable state.

Using these two vectors, the opportunity to flush the buffer only occurs when a character is to be printed and when DOS is idle. If an application uses DOS function calls to write to the printer, then DOS will always seem to be in a critical state when our INT 17 handler receives control. Moreover, the DOS idle interrupt, INT 28, probably won't be called until the application is terminated. Thus the chance to flush the buffer to disk may not arise and the buffer will probably overflow.

To deal with this situation, the system ticker interrupt can be utilised to activate our routine 18.2 times per second, thereby allowing it to regularly check its buffer and the state of DOS, flushing to disk if the conditions are right.

The strategy seems simple enough, but a couple of complications arise.

The system provides an interrupt for user programs to be activated on every timer tick, interrupt 1C. Ticks are hardware generated, and cause interrupt number 08 to occur. The Bios has its own INT 08 handler which takes care of system time updates and making sure the floppy disk drives stop spinning, and also passes control through a software interrupt to vector 1C, the user exit. Normally, vector 1C is initialised to point to an IRET instruction, so that no action takes place. User defined routines may redirect vector 1C to themselves, thus getting a second bite of the apple after the system ticker routine has done what it has to do.

A problem occurs because our ticker routine may run off to perform I/O operations — an activity which takes a small eternity in machine code terms. During the I/O operations, further ticks will occur, and these must be serviced in order to keep the system time correct and preserve the proper functioning of the machine. If DISK17 utilised vector 1C, effectively the tick event which caused it to become active

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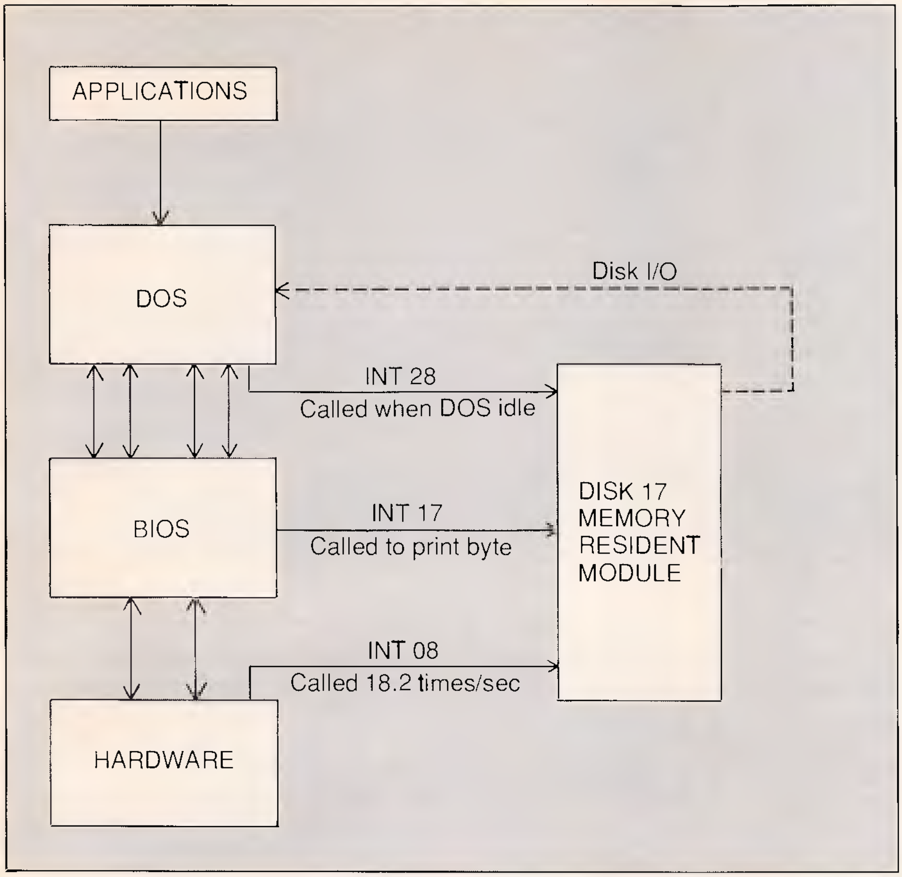

Figure 2: Structure of component interconnections

would remain uncompleted for a significant amount of time. This can cause problems in some Bios implementations, as the INT 08 handler may not expect to be called again before it has finished its previous call.

The solution is to tap into the INT 08 vector, replacing the Bios ticker handler with one of our own, and passing control through to the old Bios ticker routine. In this way, every call to the Bios routine can be guaranteed to finish before the next one starts. The same may not be true for our ticker routine, but that is ok because we're expecting it.

A second problem occurs with the INT 28 vector, and is related to knowing when to flush the buffer. A 2k buffer is obtained from dynamic memory, with a threshold set at 512 bytes. This means that calls to INT 17 will happily place printer output into the buffer until it becomes more than 512 bytes full, at which time it will add subsequent bytes to the buffer and then attempt to flush the buffer to disk, checking the DOS critical flag. The ticker operates in the same way, 18.2 times per second checking to see if the buffer holds more than 512 bytes and flushing to disk if possible.

Ideally, when the user returns to DOS command level, we should ensure that the buffer is fully flushed, thereby eliminating the need for a separate utility to flush any remaining buffered data. We know that INT 28 is called repeatedly when DOS is idle at command level, and so it would appear that our INT 28 handler can do the job simply by flushing the buffer whenever it has anything in it at all. That is, not respecting the 512 byte threshold, but writing to disk even if only a single byte remains in the buffer. This guarantees that the buffer will always be completely empty when the user returns to DOS command level.

The problem occurs because some software products seem to call INT 28 themselves when they are sitting around scanning the keyboard or printing data. Possibly this is done to improve performance under simulated 'multitasking' operating systems or with some print spoolers. This wreaks havoc, however, as it means that the buffer will be flushed to disk after every one or two bytes printed. While this behavior does not cause data loss or a system crash, it does make the printing process excruciatingly slow.

The solution is a little sneaky. Somehow the INT 28 handler must distinguish between being called by DOS when the system is idle, and being called by an application interspersed with printer output. This can be achieved simply and reliably by coding the INT 28 handler such that it flushes to disk whenever the buffer threshold is reached, and only flushes below the threshold when two consecutive calls have been made to it without the buffer size changing.

Once again, but slowly. If the INT 28 calls are originating from an application and being interspersed with printer I/O, then the buffer size will be changing from one INT 28 call to another, and there is no need to flush the buffer until the 512 byte threshold is reached. On the other hand, if DOS is truly idle (more specifically, if the stream to the printer has halted), then two consecutive calls to INT 28 may occur without the buffer size changing. If this occurs, then the INT 28 handler may safely assume that printer I/O has ceased and may flush the buffer to disk no matter how full or empty it may be.

It is possible that an entire 2k buffer load of printer data will arrive without the system ever being in a fit state for the data to be written to disk. If this occurs, DISK17 sets a return code to indicate 'printer out of paper' to the caller, although it really means 'DISK17 out of buffers'. Generally this condition will only arise if you are using the utility with some product which operates in an environmentally unusual manner. The eternal exception to the rule is, of course, DOS itself. DISK17 may experience a full buffer if you use a straight DOS COPY command to either PRN or LPTx. This should not prove to be a big problem, as you can always just copy to a file rather than copying to the printer and expecting DISK17 to redirect to a file.Finally, the three components of the system — the INT 17 printer I/O handler, the INT 08 ticker handler and the INT 28 idle handler must all be prepared to be interrupted by the INT 08 ticker at any time. The reverse is not true, because the application cannot possibly try to print another character or generate an INT 28 until we pass control back to it. However, timer ticks will always occur as they are hardware generated, and will probably even happen just as our INT 17 or INT 28 handler has taken control. They will certainly occur while one of our I/Os is in progress.

The program

The program DISK17 makes use of

Function Code (Register AH)		Input Conditions	Output Conditions
00	Print	AL = character to print DX = printer number 0 - 2	Character printed AH = printer status
01	Initialise	DX = printer number 0 - 2	Printer Initialised AH = printer status
02	Read Status	DX = printer number 0 - 2	AH = printer status

REGISTER AH STATUS BITS

7	6	5	4	3	2	1	0
Busy	Ackno- wledge	Out of Paper	Selec- ted	I/O Error	Not Used	Not Used	Time Out

Figure: 3 Bios int 17 printer interface

many of the techniques introduced in PRTDISK last month, following the classical structure of a memory resident handler.

Listing one shows the assembly language source for the program. It commences with symbol definitions for the maximum size of the buffer and the threshold point beyond which to start flushing to disk. The two macros PUSHES and POPS are used to make stack manipulations more readable. The main program commences with a simple unconditional jump to the initialisation code which is placed at the rear of the program so that it may be disposed after use.

The initialisation performed is similar to that done in PRTDISK. The existing INT 17 vector is found and followed to check for the special marker DISK17 leaves in memory, thereby preventing multiple loads. DOS function 34 is called to obtain a pointer to the DOS critical or 'call in progress' flag which is then stored in the resident portion of the module for later use. The program segment prefix (PSP) block provided by DOS is interrogated to pick up the command line parameter, which is then converted to an ASCIIZ file name and stored in the resident portion. The file is created, erasing any existing contents or printing an error message if the file name was not valid.

Finally, the initialisation resets the INT 17 vector to point at the handler, stores the old INT 28 idle vector and resets it to point to our idle handler, and does the same thing for the INT 08 ticker vector. Note that from the moment the ticker vector has been set, our routine must be ready to start dealing with ticker interrupts. The program then calls DOS to terminate itself but stay resident, calculating the number of 16 byte paragraphs required by adding the offset of the last resident byte to the size of the dynamic memory area required. This allows the program some 2144 bytes of buffer area although the COM file is only 512 bytes in total.

The data area used by the resident portion consists largely of pointers set up by the initialisation code, and a counter to show how full the buffer is. Three data items make use of dynamically allocated memory, a 32 byte file name copied from the PSP, a 2048 byte printer buffer, and a 64 byte local stack used when I/O is in progress.

Looking now to the resident portion of the program, we see three entry points, one for each of the vectors into which it is patched. The INT 17 entry point is where most of the action takes place, and commences by saving all of the callers registers, except for AX in whose place it pushes the constant 9000 which will be popped into AX upon exit and signifies a successful completion. After establishing local data addressability by copying the CS (code segment) register into DS (data segment), the program checks the command code passed to INT 17 in register AH. A value of 01 is a command to initialise the printer, a command of 02 means return the status of the printer, and a code of 00 means print the character in AL and return the printer status. Any command code other than 00 causes DISK17 to simply pass a successful completion code back to the caller.

The current size of the buffer is then loaded into SI, and checked against the maximum allowable size. If an overflow condition exists, the program reaches back into the stack and zaps the return code previously destined for AX, indicating an 'Out of Paper' error via the code 2800 and returning to the caller through the normal exit routine.

If no overflow occurred, the current byte is added to the buffer and the buffer pointer nudged along one position. The new buffer size is then compared to the threshold with a branch to the exit routine taken if the threshold has not been reached. Otherwise the DOS critical flag is checked. If the 'all clear' is given, the program prepares for disk I/O by saving the stack registers (SS:SP) and resetting them to point to its local stack claimed from dynamic memory. A local stack is necessary because we cannot be sure of the size of the callers stack, nor the stack space required by DOS to perform the I/O. The program then loads the buffer size into a register and clears the buffer size back to zero.

At that point interrupts are enabled (STI) and, more than likely a ticker interrupt will occur. Since the buffer size has just been set to zero in preparation for the write, it is acceptable for ticker interrupts to occur while the write is in progress.

If not for the fact that interrupts were left disenabled until the buffer size was set to zero, the next ticker interrupt would also try to flush the buffer at the same time, causing a dramatic system crash.

Of course, at this point the buffer size isn't really zero, just marked as

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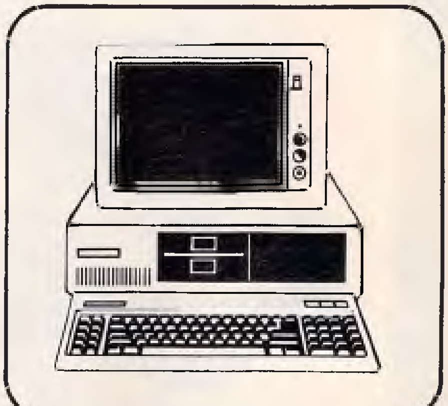

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such in order to prevent concurrent flushing. The SI register keeps track of the real buffer size.

The disk I/O performed is very conventional. The file is opened in write mode or created from scratch if the open fails. This handles the user deleting the print file, as will often happen once the contents have been used for whatever purpose. The program seeks to the end of the file, writes the buffer, and closes the file. Interrupts are then disenabled and the stack pointers reset back to the original callers stack. It is necessary to disenable interrupts just in case a ticker, keyboard, diskette or communications interrupt occurs between loading SS and SP.

Finally, the routine exists by recovering the caller's registers, including AX which will now hold a printer status code, and executing an IRET return from interrupt instruction.

The INT 28 handler commences by chaining through to the old INT 28 vector, thereby hopefully coexisting with other memory resident software. It then loads the current and previous buffer sizes into registers, resetting previous to current. If the current size is zero, the handler can safely return, otherwise if the size is over the threshold, it can safely branch into the INT 17 module without testing the critical flag and perform a write to disk. If neither of these conditions are satisfied, it checks to see if the buffer size has been changing. If so, it jumps into INT 17 and flushes the buffer, otherwise allowing the buffer to continue filling until later. As discussed last month, any program which finds itself called via INT 28 can safely assume that DOS is in a stable state.

The ticker routine is simple in comparison, chaining through to the old system ticker routine, checking to see if the buffer is past the threshold and, if so, branching into the INT 17 code and allowing it to check the DOS critical flag and return if the time is not right.

Both the INT 28 idle and INT 08 ticker handlers run with interrupts disenabled, allowing them to be turned on by the disk write routine. This should cause no problem as both routines are extremely short, and handles correctly the case of a tick interrupting INT 17, INT 28, or even INT 08.

Ticker routines are particularly difficult to debug and test, as the interrupts are hardware generated and bombard a partially tested routine in an uncontrolled cascade. Additionally, the tick may interrupt almost anything and the routine must restore the machine state exactly. The ticker routine should not assume that any significant amount of stack space will be available upon invocation, as it may have found itself in the middle of some lean user program or down the bottom of DOS. Moreover, if the routine performs anything non-trivial then it must be prepared to interrupt itself continuously. Running with interrupts disenabled for any significant length of time is not a practical option.

Ticker routines are, however, a necessary evil. Memory resident programs will not always be able to perform the tasks they might like to, and a ticker is a convenient way to keep trying on a regular basis until the system is in a suitable state.

The user view

Using DISK17 is a great deal easier than reading about it.Simply issue the DOS command DISK17 followed by the fully qualified file specification of where the print file is to be placed. Fully qualified means that you must include the drive identifier and subdirectory path, otherwise DISK17 will create files in whatever your current subdirectory happens to be at the time of the print or prints. For example:

DISK17 C:\PRINTER.DAT

You should then be able to use your system normally, with all printer output being routed to the nominated file. Multiple prints will append to the file. Exiting from an application back to DOS will ensure that the print buffer is fully flushed to disk, at which time you may use the file in any way you like.

To clear the file, simply delete it and DISK17 will recreate a new file of the same name when next you perform a print.If an 'Out of Paper' error occurs, it probably means that the application software operates in an unusual fashion and the buffer has overflowed. The system will respond with the usual 'Abort, Retry Ignore' prompt. Abort will cause the application program to terminate, retry will always come straight back with the same message, and ignore will allow the application to continue although not actually printing anything other than the first buffer load.

No facility has been provided to deinstall DISK17, as this can be achieved quite effectively by rebooting the machine.

Creating DISK17

As in previous months, two options are available for the creation of DISK17.

```
1000 DATA   "DISK17.COM"
1010 DATA   1 , E9, FB, 00, 44, 70, 2E, FF, 36, EB, 01, 53, 51,  $,  8043
1020 DATA   2 , 52, 06, 1E, 56, 57, 55, 0E, 1F, 80, FC, 00, 75,  $,  6895
1030 DATA   3 , 77, 8B, 36, EE, 01, 81, FE, 00, 08, 72, 0A, 8B,  $,  7058
1040 DATA   4 , EC, C7, 46, 10, 00, 28, EB, 64, 90, 8B, 84, 1E,  $,  8061
1050 DATA   5 , 02, FF, 06, EE, 01, 81, FE, 00, 02, 72, 55, C4,  $,  8484
1060 DATA   6 , 36, EA, 01, 26, 80, 3C, 00, 75, 48, 8C, 16, FA,  $,  7930
1070 DATA   7 , 01, 89, 26, FC, 01, 8C, D8, 8E, D0, BC, 5E, 0A,  $,  9796
1080 DATA   8 , 8B, 36, EE, 01, C7, 06, EE, 01, 00, 00, FB, BA,  $,  8663
1090 DATA   9 , FE, 01, 8B, 01, 3D, CD, 21, 73, 06, B4, 3C, 33,  $,  6624
1100 DATA  10 , C9, CD, 21, 8B, D8, B8, 02, 42, 33, C9, 8B, D1,  $,  499
1110 DATA  11 , CD, 21, 8B, CE, BA, 1E, 02, B4, 40, CD, 21, B4,  $,  9225
1120 DATA  12 , 3E, CD, 21, FA, 8E, 16, FA, 01, 8B, 26, FC, 01,  $,  8586
1130 DATA  13 , 5D, 5F, 5E, 1F, 07, 5A, 59, 5B, 58, CF, 9C, 2E,  $,  7745
1140 DATA  14 , FF, 1E, F2, 01, 50, 53, 51, 52, 06, 1E, 56, 57,  $,  5510
1150 DATA  15 , 55, 0E, 1F, 8B, 36, EE, 01, 8B, FE, 87, 3E, F0,  $,  778
1160 DATA  16 , 01, 83, FE, 00, 74, D6, 81, FE, 00, 02, 73, 85,  $,  8705
1170 DATA  17 , 3B, F7, 74, 81, EB, CA, 9C, 2E, FF, 1E, F6, 01,  $,  578
1180 DATA  18 , 2E, 81, 3E, EE, 01, 00, 02, 72, 12, 50, 53, 51,  $,  5220
1190 DATA  19 , 52, 06, 1E, 56, 57, 55, 0E, 1F, 8B, 36, EE, 01,  $,  6240
1200 DATA  20 , E9, 4E, FF, CF, 00, 90, 00, 00, 00, 00, 00, 00,  $,  2846
1210 DATA  21 , 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,  $,  0
1220 DATA  22 , 00, 00, 0E, 1F, 8B, 17, 35, CD, 21, 26, 81, 7F,  $,  6855
1230 DATA  23 , FE, 44, 70, 75, 0C, BA, 88, 02, B4, 09, CD, 21,  $,  8035
1240 DATA  24 , B8, 00, 4C, CD, 21, B4, 34, CD, 21, 89, 1E, EA,  $,  9286
1250 DATA  25 , 01, 8C, 06, EC, 01, BE, 80, 00, 8A, 0C, 80, F9,  $,  9042
1260 DATA  26 , 01, BA, EB, 02, 72, DE, 32, ED, 49, 83, C6, 02,  $,  9394
1270 DATA  27 , BF, FE, 01, 1E, 07, FC, F3, A4, C6, 05, 00, BA,  $,  9446
1280 DATA  28 , FE, 01, 33, C9, B4, 3C, CD, 21, BA, D2, 02, 72,  $,  9336
1290 DATA  29 , BF, BB, D8, B4, 3E, CD, 21, BA, 05, 01, B8, 17,  $,  7451
1300 DATA  30 , 25, CD, 21, 88, 28, 35, CD, 21, 89, 1E, F2, 01,  $,  7706
1310 DATA  31 , 8C, 06, F4, 01, BA, 9A, 01, B8, 28, 25, CD, 21,  $,  7602
1320 DATA  32 , B8, 08, 35, CD, 21, 89, 1E, F6, 01, 8C, 06, F8,  $,  8795
1330 DATA  33 , 01, BA, C6, 01, B8, 08, 25, CD, 21, BA, A3, 02,  $,  7812
1340 DATA  34 , B4, 09, CD, 21, BA, FE, 01, 81, C2, 60, 08, B1,  $,  9356
1350 DATA  35 , 04, D3, EA, 83, C2, 02, B8, 00, 31, CD, 21, 44,  $,  7592
1360 DATA  36 , 49, 53, 4B, 31, 37, 20, 6E, 6F, 77, 20, 72, 65,  $,  6642
1370 DATA  37 , 73, 69, 64, 65, 6E, 74, 2E, 24, 44, 49, 53, 4B,  $,  6040
1380 DATA  38 , 31, 37, 20, 61, 6C, 72, 65, 61, 64, 79, 20, 72,  $,  7180
1390 DATA  39 , 65, 73, 69, 64, 65, 6E, 74, 2E, 07, 24, 46, 69,  $,  5844
1400 DATA  40 , 6C, 65, 20, 63, 72, 65, 61, 74, 69, 6F, 6E, 20,  $,  7234
1410 DATA  41 , 65, 72, 72, 6F, 72, 2E, 07, 24, 53, 70, 65, 63,  $,  6464
1420 DATA  42 , 69, 66, 79, 20, 66, 75, 6C, 6C, 20, 66, 69, 6C,  $,  7391
1430 DATA  43 , 65, 73, 70, 65, 63, 2E, 07, 24,                  $,  2179
1440 DATA END,  512
```

Listing 2: Basic data statements

Readers with access to a PC assembler may enter the source code shown in listing one and generate a COM file using the following sequence of DOS commands:

MASM DISK17;
LINK DISK17;
EXE2BIN DISK17
COPY DISK17.BIN DISK17.COM
ERASE DISK17.EXE

Utilising an assembler is the preferable method, as it allows customisation of the buffer size and threshold, as well as any enhancements which come to mind.

Readers with access to a GWBASIC or BASICA interpreter can make use of the DATA statements shown in listing two. When these lines are combined with the loader presented in previous installments, running the resultant program will generate a DISK17.COM file which is identical to the one produced by the assembler. When entering the DATA statements, be sure to check the hexadecimal digits most carefully and correct any errors detected by the loader program before attempting to run the COM file.

Both versions of source code are available on Telecom Viatel, provided by SP Microtex 666 and may be downloaded directly to your computer through a 1200/75 bps modem.

The series will continue next month.

END

```
                        TITLE LPT1: to Disk
                ;
                ;
                ;         PC LPT1: redirection to disk
                ;         ============================
                ;
                ;   Australian Personal Computer Magazine, March, 1987.
                ;   Should be assembled as .COM file.
                ;   Usage is: DISK17 <drive>:<directory>\<filespec>

= 0200          Threshold       Equ     512
= 0800          Max_Buffer      Equ     2048

                .Sall
                Pushes          Macro   List
                                Irp     Reg, <List>
                                Push    Reg
                                Endm
                                Endm

                Pops            Macro   List
                                Irp     Reg, <List>
                                Pop     Reg
                                Endm
                                Endm

0000            Codeseg         Segment Para
                                Assume  CS:Codeseg,DS:Codeseg,SS:Codeseg,ES:Nothing
0100                            Org     100h

0100            MainProg        Proc    Far
0100  E9 01FE R                 Jmp     Inits                   ; Perform initialisation

                ;       ****************************************************
                ;       *       New LPT1: Interrupt Handler        (17h)   *
                ;       ****************************************************

0103  44 70     Marker:         Db      'Dp'
0105  2E: FF 36 01EB R Handler: Push    Cs:[Ret_code]           ; Return code for caller
                                Pushes  <Bx,Cx,Dx,Es,Ds,Si,Di,Bp>
0112  0E                        Push    Cs
0113  1F                        Pop     Ds                      ; Local data addressability
0114  80 FC 00                  Cmp     Ah,0                    ; Test command code
0117  75 77                     Jne     Return                  ; If not print request

0119  8B 36 01EE R              Mov     Si,[Buffer_Size]        ; Find end of buffer
011D  81 FE 0800                Cmp     Si, Max_Buffer          ; Check for Overflow
0121  72 0A                     Jb      No_Overflow             ; If no overflow
0123  8B EC                     Mov     Bp,Sp
0125  C7 46 10 2000             Mov     Word Ptr Ss:[Bp+10h],2000h ; Else "Out of Paper"
012A  EB 64 90                  Jmp     Return                  ; And abort

012D  88 84 021E R No_Overflow: Mov     Byte Ptr Buffer[Si],Al  ; Store Byte in Buffer
0131  FF 06 01EE R              Inc     [Buffer_Size]           ; Advance pointer
0135  81 FE 0200   Try_Flush:   Cmp     Si, Threshold           ; Time to Flush?
0139  72 55                     Jb      Return

013B  C4 36 01EA R              Les     Si, Critical            ; Find Pointer
013F  26: 80 3C 00              Cmp     Byte ptr Es:[Si],0      ; Is DOS Critical
0143  75 4B                     Jne     Return                  ; If so, don't write now

0145  8C 16 01FA R Write_Buffer: Mov    [Old_ss],Ss             ; Save callers stack pointers
0149  89 26 01FC R              Mov     [Old_sp],Sp
014D  8C D8                     Mov     Ax,Ds                   ; Create local stack
014F  8E D0                     Mov     Ss,Ax
0151  BC 0A5E R                 Mov     Sp, Offset Stack
0154  8B 36 01EE R              Mov     Si,[Buffer_Size]        ; Hold buffer size
0158  C7 06 01EE R 0000         Mov     [Buffer_Size],0         ; Mark Buffer as empty
015E  FB                        Sti                             ; Enable other interrupts
015F  BA 01FE R                 Mov     Dx, Offset Filename     ; Point to file name
0162  B8 3D01                   Mov     Ax,3d01h                ; Write access
0165  CD 21                     Int     21h                     ; Call DOS to open
0167  73 06                     Jnc     Append                  ; If open ok, append
0169  B4 3C                     Mov     Ah,3ch                  ; Else create file
016B  33 C9                     Xor     Cx,Cx                   ; Normal Attributes
016D  CD 21                     Int     21h
016F  8B D8        Append:      Mov     Dx, Ax                  ; Keep handle in Bx
0171  B8 4202                   Mov     Ax, 4202h
0174  33 C9                     Xor     Cx,Cx                   ; Seek to End-of_File
0176  8B D1                     Mov     Dx,Cx
0178  CD 21                     Int     21h

017A  8B CE                     Mov     Cx, Si                  ; Size to write
017C  BA 021E R                 Mov     Dx, Offset Buffer
017F  B4 40                     Mov     ah, 40h
0181  CD 21                     Int     21h                     ; Call DOS to write

0183  B4 3E                     Mov     Ah, 3eh
0185  CD 21                     Int     21h                     ; Close the file
0187  FA                        Cli                             ; No interrupts while changing
0188  8E 16 01FA R              Mov     Ss, [Old_Ss]
018C  8B 26 01FC R              Mov     Sp, [Old_Sp]            ; Replace callers stack
0190               Return:      Pops    <Bp,Di,Si,Ds,Es,Dx,Cx,Bx,Ax>
0199  CF                        Iret

                ;       ****************************************************
                ;       *       New Int28 Idle Handler             (28h)   *
                ;       ****************************************************

019A  9C           Int28:       Pushf                           ; Simulate INT for old handler
019B  2E: FF 1E 01F2 R          Call    Dword Ptr Cs:Int28_Ofs  ; Chain to old handler
                                Pushes  <Ax,Bx,Cx,Dx,Es,Ds,Si,Di,Bp>
01A9  0E                        Push    Cs
01AA  1F                        Pop     Ds                      ; Addressability
01AB  8B 36 01EE R              Mov     Si, [Buffer_Size]       ; Grab Buffer Size
01AF  8B FE                     Mov     Di, Si                  ; And Previous Size
01B1  87 3E 01F0 R              Xchg    [Prev28_Size], Di       ; Set Previous to Current

01B5  83 FE 00                  Cmp     Si, 0
01B8  74 D6                     Je      Return                  ; Is Buffer empty ?
01BA  81 FE 0200                Cmp     Si, Threshold
01BE  73 85                     Jnb     Write_Buffer            ; Is Buffer full ?
01C0  3B F7                     Cmp     Si, Di
01C2  74 81                     Je      Write_Buffer            ; Is it changing ?
01C4  EB CA                     Jmp     Return

                ;       ****************************************************
                ;       *       New Ticker Handler                 (08h)   *
                ;       ****************************************************

01C6  9C           Ticker:      Pushf                           ; Simulate INT for old handler
01C7  2E: FF 1E 01F6 R          Call    Dword Ptr Cs:[Tick_ofs] ; Chain to old handler
01CC  2E: 81 3E 01EE R 0200     Cmp     Cs:[Buffer_Size], Threshold
01D3  72 12                     Jb      Tick_Ret                ; Is Buffer full ?

                                Pushes  <Ax,Bx,Cx,Dx,Es,Ds,Si,Di,Bp>
01DE  0E                        Push    Cs
01DF  1F                        Pop     Ds                      ; Addressability
01E0  8B 36 01EE R              Mov     Si, [Buffer_Size]
01E4  E9 0135 R                 Jmp     Try_Flush
01E7  CF           Tick_Ret:    IRet

                ;       ****************************************************
                ;       *       Resident Data Area and Dynamic Buffers     *
                ;       ****************************************************

01E8  9000         Ret_Code     dw      9000h
01EA  00 00 00 00  Critical     dd      0                       ; Ptr to DOS Flag
01EE  0000         Buffer_Size  dw      0                       ; Buffer Size
01F0  0000         Prev28_Size  dw      0                       ; Buffer Size
01F2  0000         Int28_Ofs    dw      0                       ; Old Int28 Vector
01F4  0000         Int28_Seg    dw      0
01F6  0000         Tick_Ofs     dw      0                       ; Old Ticker Vector
01F8  0000         Tick_Seg     dw      0
01FA  ????         Old_ss       dw      ?
01FC  ????         Old_sp       dw      ?
= 01FE             Start_Dynam  equ     $                       ; Dynamic file name buffer
= 01FE             Filename     equ     $                       ; Dynamic file name buffer
= 021E             Buffer       equ     $ + 32                  ; Dynamic print buffer
= 0A5E             Stack        equ     $ + 32 + Max_Buffer + 64 ; Dynamic Stack area

                ;               ************************
                ;               *   Initialisation     *
                ;               ************************
```

Listing 1: Assembler source for DISK 17

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```
01FE  0E                      Inits:     Push   Cs
01FF  1F                                 Pop    Ds                     ; Addressability via DS
0200  B8 3517                            Mov    Ax,3517h               ; Find INT 17 Vector
0203  CD 21                              Int    21h                    ; Result in ES:BX
0205  26: 81 7F FE 7044                  Cmp    Word Ptr Es:[Bx-2], 'pD' ; Follow it and peek
020B  75 0C                              Jne    Not_Loaded             ; Are we resident ?



Microsoft (R) Macro Assembler  Version 4.00          3/19/87 07:30:09

LPT1: to Disk                                        Page    1-4


020D  BA 02BB R                          Mov    Bx, Offset Msg2
0210  B4 09                   Abort:     Mov    Ah,9                   ; Message if so
0212  CD 21                              Int    21h
0214  B8 4C00                            Mov    Ax,4c00h
0217  CD 21                              Int    21h                    ; And Terminate, no TSR

0219  B4 34                   Not_Loaded: Mov   Ah, 34h
021B  CD 21                              Int    21h                    ; Find DOS Critical Flag
021D  89 1E 01EA R                       Mov    Word Ptr Critical,Bx   ; and save for later
0221  8C 06 01EC R                       Mov    Word Ptr Critical+2,Es

0225  BE 0080                            Mov    Si, 80h                ; Point at command line
0228  8A 0C                              Mov    Cl,[Si]                ; and find length
022A  80 F9 01                           Cmp    Cl, 1
022D  BA 02E0 R                          Mov    Dx, Offset Msg4
0230  72 DE                              Jb     Abort                  ; Abort if no parm
0232  32 ED                              Xor    Ch,Ch
0234  49                                 Dec    Cx
0235  83 C6 02                           Add    Si,2                   ; skip into text
0238  BF 01FE R                          Mov    Di, Offset Filename
023B  1E                                 Push   Ds
023C  07                                 Pop    Es
023D  FC                                 Cld
023E  F3/ A4                             Rep    Movsb                  ; Copy to dynamic buffer
0240  C6 05 00                           Mov    Byte Ptr [di],0        ; Add ASCIIZ terminator

0243  BA 01FE R                          Mov    Dx, Offset Filename
0246  33 C9                              Xor    Cx,Cx                  ; Normal Attributes
0248  B4 3C                              Mov    Ah, 3ch
024A  CD 21                              Int    21h                    ; Create file
024C  BA 02D2 R                          Mov    Dx, Offset Msg3        ; Print message and
024F  72 BF                              Jc     Abort                  ; abort if not created
0251  8B D8                              Mov    Bx, Ax                 ; Copy handle to BX
0253  B4 3E                              Mov    Ah, 3eh
0255  CD 21                              Int    21h                    ; Close file

0257  BA 0105 R                          Mov    Dx, Offset Handler     ; Set Int17 vector to handler
025A  B8 2517                            Mov    Ax, 2517h
025D  CD 21                              Int    21h

025F  B8 3528                            Mov    Ax, 3528h              ; Find Int28 Idle vector
0262  CD 21                              Int    21h
0264  89 1E 01F2 R                       Mov    [Int28_Ofs],bx         ; Save old vector
0268  8C 06 01F4 R                       Mov    [Int28_Seg],es
026C  BA 019A R                          Mov    Dx, Offset Int28
026F  B8 2528                            Mov    Ax, 2528h
0272  CD 21                              Int    21h                    ; And reset vector to us

0274  B8 3508                            Mov    Ax, 3508h              ; Find Ticker vector
0277  CD 21                              Int    21h
0279  89 1E 01F6 R                       Mov    [Tick_Ofs],bx          ; Save old vector
027D  8C 06 01F8 R                       Mov    [Tick_Seg],es
0281  BA 01C6 R                          Mov    Dx, Offset Ticker
0284  B8 2508                            Mov    Ax, 2508h
0287  CD 21                              Int    21h                    ; And reset vector to us

0289  BA 02A3 R                          Mov    Dx, Offset Msg1
028C  B4 09                              Mov    Ah,9
028E  CD 21                              Int    21h                    ; Display message

0290  BA 01FE R                          Mov    Dx, Offset Inits       ; Find size of resident portion
0293  81 C2 0060                         Add    Dx, Stack - Start_Dynam ; Plus Dynamics
0297  B1 04                              Mov    Cl, 4
0299  D3 EA                              Shr    Dx,Cl                  ; Convert to paragraphs
029B  83 C2 02                           Add    Dx, 2
029E  B8 3100                            Mov    Ax,3100h               ; Set return code to 0
02A1  CD 21                              Int    21h                    ; Terminate & Stay Res.


02A3  44 49 53 4B 31 37 20    Msg1       db      'DISK17 now resident.$'
      6E 6F 77 20 72 65 73
      69 64 65 6E 74 2E 24

02B8  44 49 53 4B 31 37 20    Msg2       db      'DISK17 already resident.',7,'$'
      61 6C 72 65 61 64 79
      20 72 65 73 69 64 65
      6E 74 2E 07 24
02D2  46 69 6C 65 20 63 72    Msg3       db      'File creation error.',7,'$'
      65 61 74 69 6F 6E 20
      65 72 72 6F 72 2E 07
      24
02E0  53 70 65 63 69 66 79    Msg4       db      'Specify full filespec.',7,'$'
      20 66 75 6C 6C 20 66
      69 6C 65 73 70 65 63
      2E 07 24


                              Mainprog   EndP
0300                          Codeseg    EndS
                                         End     Mainprog              ; Set entry point
```

```
LPT1: to Disk                                  Symbols-1

Macros:

           N a m e                  Lines

POPS . . . . . . . . . . . . . .      3
PUSHES . . . . . . . . . . . . .      3

Segments and Groups:

           N a m e                  Size   Align  Combine Class

CODESEG  . . . . . . . . . . . .    0300   PARA   NONE

Symbols:

           N a m e                  Type   Value  Attr

ABORT  . . . . . . . . . . . . .    L NEAR 0210   CODESEG
APPEND . . . . . . . . . . . . .    L NEAR 016F   CODESEG

BUFFER . . . . . . . . . . . . .    NEAR   021E   CODESEG
BUFFER_SIZE  . . . . . . . . . .    L WORD 01EE   CODESEG

CRITICAL . . . . . . . . . . . .    L DWORD 01EA  CODESEG

FILENAME . . . . . . . . . . . .    NEAR   01FE   CODESEG

HANDLER  . . . . . . . . . . . .    L NEAR 0105   CODESEG

INITS  . . . . . . . . . . . . .    L NEAR 01FE   CODESEG
INT28  . . . . . . . . . . . . .    L NEAR 019A   CODESEG
INT28_OFS  . . . . . . . . . . .    L WORD 01F2   CODESEG
INT28_SEG  . . . . . . . . . . .    L WORD 01F4   CODESEG

MAINPROG . . . . . . . . . . . .    F PROC 0100   CODESEG Length = 0200
MARKER . . . . . . . . . . . . .    L NEAR 0103   CODESEG
MAX_BUFFER . . . . . . . . . . .    Number 0080
MSG1 . . . . . . . . . . . . . .    L BYTE 02A3   CODESEG
MSG2 . . . . . . . . . . . . . .    L BYTE 02B8   CODESEG
MSG3 . . . . . . . . . . . . . .    L BYTE 02D2   CODESEG
MSG4 . . . . . . . . . . . . . .    L BYTE 02E0   CODESEG

NOT_LOADED . . . . . . . . . . .    L NEAR 0219   CODESEG
NO_OVERFLOW  . . . . . . . . . .    L NEAR 012B   CODESEG

OLD_SP . . . . . . . . . . . . .    L WORD 01FC   CODESEG
OLD_SS . . . . . . . . . . . . .    L WORD 01FA   CODESEG

PREV28_SIZE  . . . . . . . . . .    L WORD 01F0   CODESEG

RETURN . . . . . . . . . . . . .    L NEAR 0190   CODESEG
RET_CODE . . . . . . . . . . . .    L WORD 01E8   CODESEG

STACK  . . . . . . . . . . . . .    NEAR   025E   CODESEG
START_DYNAM  . . . . . . . . . .    NEAR   01FE   CODESEG

THRESHOLD  . . . . . . . . . . .    Number 0200
TICKER . . . . . . . . . . . . .    L NEAR 01C6   CODESEG
TICK_OFS . . . . . . . . . . . .    L WORD 01F6   CODESEG
TICK_RET . . . . . . . . . . . .    L NEAR 01E7   CODESEG
TICK_SEG . . . . . . . . . . . .    L WORD 01F8   CODESEG
TRY_FLUSH  . . . . . . . . . . .    L NEAR 0135   CODESEG

WRITE_BUFFER . . . . . . . . . .    L NEAR 0145   CODESEG


    246 Source  Lines
    293 Total   Lines
     58 Symbols

  49256 Bytes symbol space free

      0 Warning Errors
      0 Severe  Errors
```

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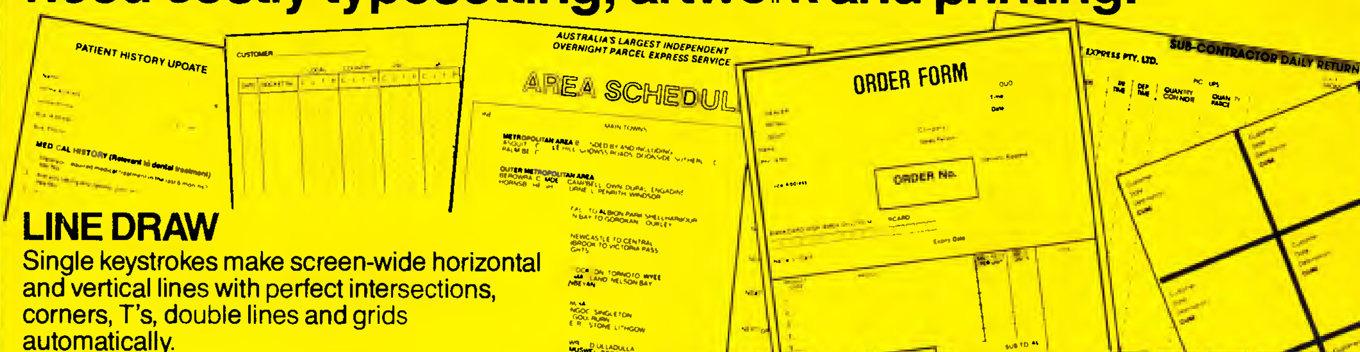

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continued from page 12

in handle. Watch out Toshiba.

Vicom had the new GridLite, a highly IBM-compatible version of the GridCase but with a plastic shell in place of the previous aluminium one and a better keyboard layout. A very elegant machine, it also featured the smallest external floppy disk drive I have ever seen — small enough to fit easily into a coat pocket.

Also there was the new Compaq Portable III, a 80286-powered transportable with a plasma screen, 51/4in disk drive with 20 or 40Mbytes hard disk. This machine offers more of everything than the rival Toshiba T3100 — more speed, more memory, more hard disk storage, more IBM-style expansion slots but, unfortunately, more size and weight.

AWA-Mitsubishi attracted a lot of attention with its low-priced Amstrad PC1512 IBM-compatible, a very clean looking cheapie. It was also running many of the new GEM packages, most of which have not been seen before. These include GEM Graph, GEM WordChart and GEM Communications.

And finally, two innovations which seemed to please both visitors and exhibitors: for the first time children under the age of 16 were banned unless accompanied by an adult. The exhibitors were particularly pleased with this, one saying this was the first year in which no one had stolen any software or mice.

And finally, no Saturday showing. Again exhibitors were in favour, saying that not only were Saturdays the worst days for them, but that anyone who really wanting to see the show will have already done so.

All in all, one of the best shows in years.'

Gary Ross

END

MACHINE MAKE	MULTITECH	MULTITECH	MULTITECH
MACHINE MODEL	PC500 SYSTEM 1	PC700	PC900
MACHINE TYPE	PC	PC/XT	PC/AT
PROCESSOR	8088	8088-2	80286
PROCESSOR SPEED	4.77MHz	4.77/8MHz	6/10MHz
STANDARD RAM	256k	640k	512k
MAX RAM WITHOUT CARDS	512k	640k	1024k
MAX RAM WITH CARDS	N/A	N/A	N/A
STANDARD ROM	8k	8k	64k
ROM COPYRIGHT HOLDER	MULTITECH CORP		MULTITECH AWARD
8087/80287 SOCKET	N	Y	Y
8087/80287 SUPPLIED	N	N	N
BATTERY REALTIME CLOCK/CAL	Y	Y	Y
NO. OF FLOPPIES	1	1	1
MAX NO. INTERNAL FLOPPIES	2	1	2
MAX FLOPPY CAPACITY	360k	360k	1.2Mbyte
FLOPPY HT (HALF/FULL)	H	H	H
HARD DISK CAPACITY	N/A	20Mbyte	20Mbyte
HARD DISK HEIGHT (H/F)	N/A	H	F
AVER HARD DISK SPEED	N/A	65ms	39ms
HARD DISK ACTUATOR TYPE	N/A	stepper	voice coil
MAX NO HARD DISKS	N/A	2	2
DISPLAY ADAPTOR	CGA	MGA	MGA
COLOUR/MONO MONITOR	N/A	MON	MON
BUILT IN MODEM	N/A	N/A	N/A
MODEM TYPE	N/A	N/A	N/A
KEYBOARD LAYOUT	PC	AT	AT
NO KEYS	84	97	97
NO FUNCTION KEYS	10	10	10
SEP NO & CURSOR KEYPADS	N	Y	Y
MOUSE SUPPLIED	N	N	N
RESET BUTTON	N	Y	Y
NO RS232 PORTS	1	2	2
NO PARALLEL PORTS	1	2	2
NO 8-BIT EXPANSION SLOTS	4	6	8
NO 16-BIT EXPANSION SLOTS	0	0	6
OTHER PORTS	N/A	N/A	N/A
OTHER SLOTS	N/A	N/A	N/A
POWER SUPPLY	67watts	103watts	197watts
WEIGHT	12kg	15.5kg	17.2kg
DIMENSIONS	40x12x38cm	44x15x40cm	50x16.5x45cm
MACHINE MAKE	MULTITECH	MULTITECH	MULTITECH
MACHINE MODEL	PC500 SYSTEM 1	PC700	PC900
MACHINE TYPE	PC	PC/XT	PC/AT
DOS VERSION	3.1	3.1	3.2
GW BASIC SUPPLIED	N	N	N
SCHEMATICS AVAILABLE	Y	Y	Y
OTHER FEATURES	N/A	8MHzCLOCK SPEED	DUAL CLOCK SPEED 6/10MHz
DOCUMENTATION SUPPLIED	DOS 3.1 MANUAL SYSTEM & CGA CARD MANUALS	DOS 3.1 MANUAL SYSTEM & CGA CARD MANUALS	DOS 3.2 MANUAL SYSTEM & DISPLAY CARD MANUALS
UNIQUE OPTIONS	SMALL SIZE FOR DESKTOP MACHINE	SIX MONTHS WARRANTY ON SITE	SIX MONTHS WARRANTY ON SITE
MAINTENANCE CONTRACT AVAIL	Y	Y	Y
MAINTENANCE BY	DSE	DSE	DSE
IS IT 'RETURN TO DEPOT' BASIS	N	N	N
PRICE OF CONFIGURATION	$995	$4295	$6195
SUPPLIER/PH. NUMBER	DICK SMITH ELECTRONICS (02)888 3200	DICK SMITH ELECTRONICS (02)888 3200	DICK SMITH ELECTRONICS (02)888 3200

The computer used to collate last month's PC Buyers Guide supplement to APC swallowed up Dick Smith Electronics' entry. We know this because a large number of angry phone calls were received by us from DSE. So to make partial amends, this is the data which should have appeared last issue. We won't name the supplier of the computer which lost the data — 'cause we'd just get a whole lot more angry phone calls from DSE.

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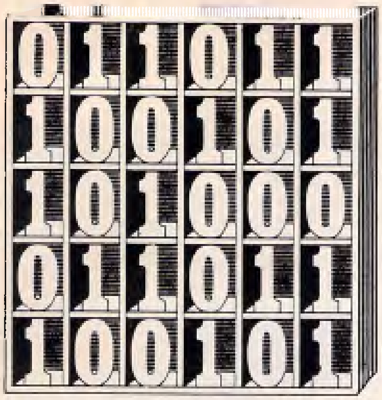

David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Subset, APC, 2nd Floor, 215 Clarence Street, Sydney 2000.

Z80 RADIX CONVERSION

CONVHL (Datasheet 1) from John Kerr will convert a 16-bit value to an ASCII string in any of several different bases.

The routine is part of a 1094-byte Z80 disassembler that John has written for this PCW8256. Because of the need to pack a lot of processing power into a compact program, CONVHL is heavily optimised for brevity and the input parameters are of a completely non-standard form. Not only is the radix, or base, limited to an even number between 2 and 16, but it must also be input-halved and twos-complemented for the optimised algorithm that John uses. CONVHL also fails to check for, and abort on, invalid input.

These faults are not serious if CONVHL is considered only as a subroutine of one program that does pass a correctly formatted radix on each of the few calls made to the routine. However, if you want to use CONVHL as a standalone routine, it would be wise to include a preparatory sequence to validate input and convert from a standard form of radix to that required by the algorithm.

DATASHEET 1

```
;==========================================================================
; CALL :         CONVHL
;                Base conversion of a 16-bit value to an ASCII string
;                of even radix =< 16, suppressing leading zeros and
;                appending one leading zero where the m.s. digit > 9.
;==========================================================================
; STRUCTURAL  CONCEPTS
;PROGRAM         digit = terminator.
;                UNTIL number = 0
;                {
;                  STACK digit.
;                  digit = number MOD radix.
;                  number = number DIV radix.
;                }
;                IF digit > 9
;                [
;                  STACK digit.
;                  digit = 0.
;                ]
;                UNTIL digit = terminator
;                {
;                  digit = ASCII digit.
;                  STORE digit.
;                  DE-STACK digit.
;                }
;--------------------------------------------------------------------------
; SYSTEM  REQUIREMENTS
;PROCESSOR       Z80
;HARDWARE        None.
;SOFTWARE        Written as a local subroutine for a Z80 disassembler.
;--------------------------------------------------------------------------
; PROGRAMMING  DETAILS
;INPUT           HL contains unsigned 16-bit number.
;                DE indexes output buffer.
;                C = twos complement of the required "half-radix",
;                (0FCH = octal, 0FBH = decimal, 0F8H = hex, etc.)
;OUTPUT          ASCII string in output buffer.
;                DE indexes next free buffer byte (string +1).
;STATE CHANGES   DE updated. AF, BC and HL changed.
;I/O ERRORS      Unflagged invalid result if input is for an odd
;                number radix or radix greater than 16.
;OPTIMISATION    The input radix must have been pre-adjusted to the
;                form required by the routine.
;                A "half-radix" is used for subtraction before
;                dividend is shifted to remainder accumulator in
;                the conversion division.
;                The twos complement of the divisor is used to

;                remove the need to complement each result bit.
;                A leading zero is appended by performing one
;                extra iteration of the radix conversion.
;                Conversion of hex to ASCII depends on the action
;                of the Decimal Adjust Accumulator instruction.
;INTERRUPT EFFECT May be interrupted and re-entered.
;LOCATION NEEDS  Not specific. Relocatable and PROMable.
;PROGRAM BYTES   32
;STACK BYTES     10 maximum.
;CLOCK CYCLES    4277 maximum.
;==========================================================================
;
CONVHL   SUB  A              ;Initially stack Z terminator.  97
;
;...Radix conversion loop - repeatedly divide by radix until zero.
;
CVHL1    PUSH AF             ;Stack terminator or remainder  F5
         SUB  A              ;digit. Clear accumulator.      97
         LD   B,16           ;Set 16-bit division count.     06 10
;
;...Radix division loop - find next remaining digit.
;
CVHL2    ADD  A,C            ;Long division by adding twos   81
         JR   C,CVHL3        ;complement of half-radix to    38 01
         SUB  C              ;remainder accumulator before   91
CVHL3    ADC  HL,HL          ;shifting (if it goes), then    ED 6A
         RLA                 ;shifting quotient bit into     17
         DJNZ CVHL2          ;HL. Repeat for 16 bits.        10 F7
;
         JR   NZ,CVHL1       ;Repeat until quotient HL = 0.  20 F1
;
         CP   10             ;If most significant digit is   FE 0A
         INC  B              ;a letter then (clearing Z)     04
         JR   NC,CVHL1       ;iterate for a leading zero.    30 EC
;
;...De-stack, convert to ASCII and store to buffer.
;
CVHL4    CP   10             ;Set Cy if 0-9, SBC sets half   FE 0A
         SBC  A,69H          ;carry flag if 0-9, DAA         DE 69
         DAA                 ;completes ASCII conversion.    27
         LD   (DE),A         ;Store ASCII to buffer and      12
         INC  DE             ;bump pointer.                  13
         POP  AF             ;Retrieve next digit, repeat    F1
         JR   NZ,CVHL4       ;until terminator.              20 F6
;
         RET                 ;Exit, ASCII in buffer.         C9
;==========================================================================
```

CONVERSION TO ASCII

Have a look at the tricky method John uses in CONVHL to convert the raw digits (0-9 and A-F) to ASCII (30H-39H and 41H-46H) at label CVHL4.

CP 10 and SBC A,69H are used to pre-adjust the value in the accumulator and to set the carry and half-carry flags correctly. The final adjustment relies on the Z80's DAA instruction subtracting a 6 from each digit, depending on the state of the flags.

The method is quite ingenious and saves 3 bytes and 8 or 10 clock cycles (time states) on the normal method of testing for the

break between digits 9 and A, adding 7 if the digit is a letter. Unfortunately, it cannot cope with any base higher than hexadecimal.

8086 BLOCK TRANSFER

Datasheet 2, IBT86, from Terry Browning almost solves the problems, discussed in the December 1986 SubSet, of shifting overlapping blocks of data in segmented 8086 memory.

Both sources and destination addressses are standardised so that each segment register has the highest possible value, and the offset in SI and DI is no more than 000FH. This method makes comparison easy, but does not entirely eliminate the problem of segment wrap-around. It will occur if offset plus byte count exceeds the segment size (64k). IBT86 is intelligent enough to abort in these few cases — but should it abort or find some way to move these few awkward bytes?

The 8086 can address 1Mbyte of memory in 64k segments at any 16-byte boundary. Is it too much to expect a routine capable of moving a complete 64k segment? And why limit the move to just one segment? There is still room for a great deal of improvement to be made to IBT86.

The documentation of Datasheet 2 was devised by Terry and is based on previous SubSet datasheet formats. No format is sacred: the only object is to provide clear and necessary information about a routine.

DATASHEET 2

```
;DATA MOVEMENT
;INTELLIGENT BLOCK TRANSFER
;IBT86
;
;OBJECTIVES
;     JOB             Move a block of bytes from source to destination
;                     without overwriting the source before moving it.
;     ALGORITHM       Standardise then compare the source and destination
;                     addresses, moving the data accordingly.
;
;SOFTWARE DEPENDANCE
;     LANGUAGE        Intel iAPX assembly language.
;     DIALECT         8086.
;
;HARDWARE DEPENDANCE
;     MACHINE         Intel iAPX processor.
;     MODEL           8086, 80286 or 80386.
;
;RESOURCES CONSUMED
;     MEMORY/TIME     Bytes: 135 program; 20 (22 for 80386) stack.
;                     Cycles: (n = number of bytes moved), (approximate).
;                       8086: Unknown.
;                       80286: 251 + 19ifdown + 2.5ifodd + 4.5 * n.
;                       80386: 242 + 19ifdown + 4.5ifodd + 4.5 * n.
;     OTHER           None.
;
;INTERFACES
;     HOW TO USE      3 inputs; 1 output.
;          INPUTS     CX = number of bytes.
;                     SI = source block start address.
;                     DI = destination block start address.
;          OUTPUT     Flag          OK          Error
;                     OV            Clear       Set
;     SUPPORT         The call MUST be FAR.
;
;ERRORS
;     TRAPPED         Either block exceeding the limits of the addressing
;                     range (00000H to 0FFFFFH), attempting to move too
;                     many bytes (the limit is between 65520 bytes and
;                     65535 bytes, depending on the exact value of the
;                     bottom nibble of source and destination indexes).
;     UNTRAPPED       If run on an 80386, the top word of ECX must be
;                     zero; the top words of ESI and EDI must either be
;                     the same, or the source and destination indexes
;                     must be at least 1MB apart.
;

IBT86   PROC    FAR             ;Intersegment calls.
;
        PUSH    AX              ;Save the contents of           50
        PUSH    BX              ;all registers to be            53
        PUSH    CX              ;used in IBT86.                 51
        PUSH    DX              ;                               52
        PUSH    SI              ;                               56
        PUSH    DI              ;                               57
        PUSH    DS              ;                               1E
        PUSH    ES              ;                               06
        PUSH    BP              ;                               55
        PUSHF                   ;Push flags.                    9C
;
        MOV     DX,CX           ;Save count in DX.              8BD1
        MOV     BP,SP           ;Index stacked flags.           8BEC
        MOV     CH,4            ;Nibble shift count template.   B5      04
        OR      [BP],0800H      ;Set overflow flag on stack.    814E 00 0008
;
;...Source address = DS * 16 + SI. Compute highest Segment value...
;...Standardise: DS = DS + (SI \ 16). SI = SI AND 000FH
;
        MOV     AX,SI           ;Get source offset              8BC6
        MOV     CL,CH           ;and divide by 16 to            8ACD
        SHR     AX,CL           ;find segment component.        D3E8
        MOV     BX,DS           ;Get source segment and add     8CDB
        ADD     AX,BX           ;to new component, DS is now    03C3
        MOV     DS,AX           ;highest possible segment of    8ED8
        JC      ABORT           ;source. Abort if memory wrap.  72   59
;
        AND     SI,0FH          ;Source offset now in 1st 16    81E6    0F00
        MOV     AX,SI           ;bytes of segment. Check if     8BC6
        ADD     AX,DX           ;offset + count wraps around    03C2
        JC      ABORT           ;segment and abort if so.       72   4F
;
;...Destination address = ES * 16 + DI. Compute highest Segment value...
;...Standardise: ES = ES + (DI \ 16). DI = DI AND 000FH
;
        MOV     AX,DI           ;Get destination offset         8BC7
        MOV     CL,CH           ;and divide by 16 to find       8ACD
        SHR     AX,CL           ;new segment component.         D3E8
        MOV     BX,ES           ;Add input segment value to     8CC3
        ADD     AX,BX           ;new component, making ES       03C3
        MOV     ES,AX           ;highest possible segment of    8EC0
        JC      ABORT           ;dest. Abort if memory wrap.    72   41
;
        AND     DI,0FH          ;Dest. offset now in 1st 16     81E7    0F00
        MOV     AX,DI           ;bytes of segment. Check if     8BC7
        ADD     AX,DX           ;offset + count wraps around    03C2
        JC      ABORT           ;segment and abort if so.       72   37
;
;
;...Form addresses into 20-bit sequences in DS,AL and ES,BL for easy
;...comparison with any carry out of lowest nibbles subtraction.
;
        MOV     AX,SI           ;Get source offset (= 0 to F)   8BC6
        MOV     CL,CH           ;and move it into high order    8ACD
        SHL     AX,CL           ;nibble of AL, clearing low     D3E0
        MOV     BX,DI           ;order nibble.                  8BDF
        MOV     CL,CH           ;Repeat for destination         8ACD
        SHL     BX,CL           ;offset into high order         D3E3
        MOV     CX,DX           ;nibble of BL.                  8BCA
;
        SUB     AL,BL           ;Subtract (src - dst) lowest    2AC3
        MOV     AX,DS           ;digits first, then highest     8CD8
        MOV     BX,ES           ;four digits, setting C only    8CC3
        SBB     AX,BX           ;if source address is lower     1BC3
        JNC     UPBT            ;than destination address.      73   11
;
;...Source lower than dest. so move from highest addresses downwards.
;
        ADD     SI,CX           ;Set offset pointers to         03F1
        DEC     SI              ;highest bytes by adding        4E
        ADD     DI,CX           ;byte count, subtracting 1.     03F9
        DEC     DI              ;                               4F
;
        STD                     ;Set D for auto-dec MOVS.       FD
        SHR     CX,1            ;CX = word count, C = odd       D1E9
        JNC     DNEVEN          ;byte, skip if no odd byte.     73   02
;
        INC     CX              ;Add 1 for byte move and        41
        MOVSB                   ;move odd byte.                 A4
;
DNEVEN  DEC     SI              ;Set offset pointers to low     4E
        DEC     DI              ;bytes of 1st word to move      4F
        JMPS    EVENMV          ;then go move by words.         EB   07
;
;...Source >= dest. so move from lowest addresses upwards.
;
UPBT    CLD                     ;Clear D for auto-inc MOVS.     FC
        SHR     CX,1            ;CX = word count, C = odd       D1E9
        JNC     EVENMV          ;byte, skip if no odd byte.     73   02
;
        INC     CX              ;Add 1 for byte move and        41
        MOVSB                   ;move odd byte.                 A4
;
;...Move majority of data by word move, up or down on state of D flag.
;
EVENMV  REP     MOVSW           ;move remaining words, then     F3A5
        XOR     [BP],0800H      ;clear OV to show move done.    8176 00 0008
;
ABORT   POPF                    ;Restore flags, with overflow   9D
        POP     BP              ;clear if move occurred.        5D
        POP     ES              ;Restore all registers          07
        POP     DS              ;to entry state.                1F
        POP     DI              ;                               5F
        POP     SI              ;                               5E
```

```
         POP    DX         ;                        5A
         POP    CX         ;                        59
         POP    BX         ;                        5B
         POP    AX         ;                        58
         RET               ;Intersegment return.    CB
;
IBTB6    ENDP
;
```

6502 STRAIGHT LINES

LINE 16 (Datasheet 3) from Mario Camilleri calculates all intermediate points between start and end coordinates — both taken as 16-bit signed values. Mario estimates that the routine is capable of generating about 13000 points a second at 2MHz.

The routine will not plot the actual points to screen, nor will it convert the signed values to valid screen coordinates. Both of these activities are hardware dependent and slow down the plotting rate considerably. However, in a dedicated system, the routine could be adapted to work directly with valid screen coordinates — even to the extent of having a preceding routine to clip the line to the current window size, and this would regain some of the lost time. As it stands, LINE 16 is a good, general-purpose, line-drawing routine.

Mario gives two references for the algorithm he uses: (i) Bresenham JE (1965); *Algorithm for Computer Control of Digital Plotter.* (IBM System Journal 4(1) 1965, pp25ff).

(ii) Cesa L, Kellerman E, Hitchcock R (1978); *An Algorithm for Drawing Lines* (quoted in Liffick BW (ed) (1979) Bits and Pieces, *Byte Publications*).

DATASHEET 3

```
;
; CALL :           LINE16
;                  Plot a straight line segment given signed 16-bit
;                  start and end coordinates.
;
; STRUCTURAL CONCEPTS
;PROGRAM           IF startx > endx
;                  [
;                    SWAP startx,endx.
;                    SWAP starty,endy.
;                  ]
;                  diffx = endx - startx.
;                  diffy = ABS (endy - starty).
;                  stepy = SGN (endy - starty) OR 1.
;                  stepcount = GREATER (diffx,diffy) \ 2.
;                  UNTIL endtest = 0
;                  {
;                    PLOT (startx,starty).
;                    IF diffx > diffy
;                    [
;                      endtest = endx - startx.
;                      startx = startx + 1.
;                      stepcount = stepcount - diffy.
;                      IF stepcount =< 0
;                      [
;                        stepcount = stepcount + diffx.
;                        starty = starty + stepy.
;                      ]
;                    :
;                      endtest = endy - starty.
;                      starty = starty + stepy.
;                      stepcount = stepcount - diffx.
;                      IF stepcount =< 0
;                      [
;                        stepcount = stepcount + diffy.
;                        startx = startx + 1.
;                      ]
;                    ]
;                  }
;
; SYSTEM REQUIREMENTS
;PROCESSOR         6502
;HARDWARE          Bit mapped display.
;SOFTWARE          "PLOT" - Plot a pixel on a bit mapped display, using
;                           16-bit coordinates (M0,1 = x, M2,3 = y).
;                  "INCRY" - local subroutine to adjust y coordinate.
;
; PROGRAMMING DETAILS
;INPUT             M0,1 = Start x coordinate.
;                  M2,3 = Start y coordinate.
;                  M4,5 = End x coordinate.
;                  M6,7 = End y coordinate.
;OUTPUT            Line plotted.
;STATE CHANGES     M0 to MF, registers A, X and Y changed. P preserved.
;I/O ERRORS        None known.
;OPTIMISATION      Depends on PLOT to filter out off-screen pixels.
;INTERRUPT EFFECT  May be interrupted. May be reentered only if registers
;                  and M0 to MF are saved by interrupting routine.
;LOCATION NEEDS    Not specific. Not relocatable. PROMable.
;PROGRAM BYTES     204
;STACK BYTES       3
;CLOCK CYCLES      approx. (98 to 248) + (62 to 147) * pixels.
;
;
;...Define page zero input and workspace.
;
STRX     =    M0        ;Word input, start x coordinate.
STRY     =    M2        ;Word input, start y coordinate.
ENDX     =    M4        ;Word input, end x coordinate.
ENDY     =    M6        ;Word input, end y coordinate.
DX       =    M8        ;Word w/space, end x - start x.
DY       =    MA        ;Word w/space, magnitude (end y - start y)
COUNT    =    MC        ;Word w/space, step counter.
STEP     =    ME        ;Byte w/space, y step hi-byte (00 or FF)
AXIS     =    MF        ;Byte w/space, index to x or y parameters.
;
LINE16   PHP            ;Save flags and clear decimal             08
         CLD            ;flag to ensure binary arithmetic.        D8
;
;...Calculate parameters.
;
CALCDX   LDX  #0        ;Clear for later indexing.                A2 00
         SEC            ;Prepare to subtract.                     38
         LDA  ENDX      ;Calculate difference between             A5 M4
         SBC  STRX      ;start x and end x, storing the           E5 M0
         STA  DX        ;result in DX.                            85 M8
         LDA  ENDX+1    ;                                         A5 M5
         SBC  STRX+1    ;LINE16 needs positive DX                 E5 M1
         STA  DX+1      ;so test for signed overflow or           85 M9
         BVC  NOOV1     ;negative values.                         50 01
         ROR  A         ;If overflow, get sign to sign bit A.     6A
NOOV1    BPL  CALCDY    ;If positive, calc DY, else...            10 0F
;
SWAP     LDY  STRX,X    ;indexing all 4 bytes of x & y coords,    B4 M0
         LDA  ENDX,X    ;exchange start and end                   B5 M4
         STA  STRX,X    ;coordinates (draw line in reverse        95 M0
         STY  ENDX,X    ;direction) so that DX will be            94 M4
         INX            ;positive.                                E8
         CPX  #4        ;                                         E0 04
         BNE  SWAP      ;                                         D0 F3
         BEQ  CALCDX    ;With ends reversed, recalculate DX.      F0 DD
;
CALCDY   SEC            ;Prepare to subtract.                     38
         LDA  ENDY      ;Calculate difference between             A5 M6
         SBC  STRY      ;start y and end y, storing the           E5 M2
         STA  DY        ;result in DY.                            85 MA
         LDA  ENDY+1    ;                                         A5 M7
         SBC  STRY+1    ;LINE16 needs magnitude of DY             E5 M3
         STA  DY+1      ;so test for signed overflow or           85 MB
         BVC  NOOV2     ;negative values.                         50 01
         ROR  A         ;If overflow, get C as sign in A.         6A
NOOV2    BPL  DYPOS     ;If positive, do STEP = 0, else...        10 0C
;
         TXA            ;(using X=0 from routine start)           8A
         SEC            ;find 2s complement of difference         38
         SBC  DY        ;to give magnitude, i.e. the number       E5 MA
         STA  DY        ;of points between y start and end.       85 MA
         TXA            ;Direction of movement will be            8A
         SBC  DY+1      ;achieved by incrementing or              E5 MB
         STA  DY+1      ;decrementing by adding STEP.             85 MB
         DEX            ;Set X = -1 for negative STEP.            CA
;
DYPOS    STX  STEP      ;y coord STEP (hi-byte) = 0 or -1.        86 ME
         LDA  DY+1      ;Find greater of DY,DX.                   A5 MB
         CMP  DX+1      ;If DX>DY then x is stepped every loop    C5 M9
         BNE  C1        ;else y is stepped every loop.            D0 04
         LDA  DY        ;                                         A5 MA
         CMP  DX        ;Shift comparison result to bit 1,A       C5 M8
C1       ROL  A         ;so that A=0 if DX>DY and x is the        2A
         ROL  A         ;control coord, else A=2 if DX=<DY        2A
         AND  #2        ;and y is the control coord.              29 02
         STA  AXIS      ;Store A in AXIS as index to x or y       85 MF
         TAX            ;Using x or y index,                      AA
         LDA  DX+1,X    ;get (greater of DX or DY) / 2            B5 M9
         LSR  A         ;as initial value of count.               4A
         STA  COUNT+1   ;Whenever count goes below 1, it will     85 MD
         LDA  DX,X      ;be incremented by control coord          B5 M8
         ROR  A         ;difference. This initialisation gives    6A
         STA  COUNT     ;a half step at both ends of the line.    85 MC
;
;...Begin plotting.
;
LOOP     JSR  PLOT      ;Plot pixel at (M0,1 = x, M2,3 = y).      20 lo hi
         LDX  AXIS      ;Using x or y index,                      A6 MF
         LDA  STRX+1,X  ;test if current point (just plotted)     B5 M1
         CMP  ENDX+1,X  ;equals last point to plot.               D5 M5
         BNE  C2        ;                                         D0 06
         LDA  STRX,X    ;                                         B5 M0
         CMP  ENDX,X    ;                                         D5 M4
         BEQ  EXIT      ;Exit LINE16 if last point plotted.       F0 59
;
C2       TXA            ;Complement the x or y index so that      8A
```

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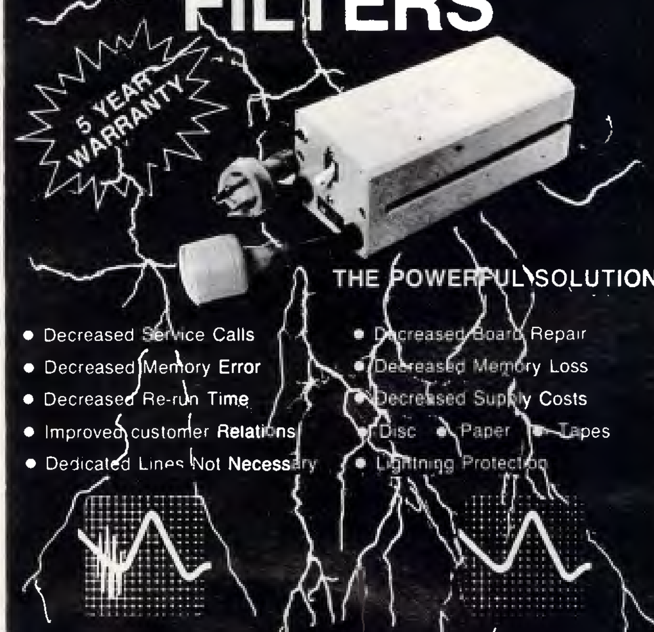
```
          EOR  #2        ;it indexes the lesser difference.        49 02
          TAX            ;                                         AA
          SEC            ;Prepare to subtract.                     38
          LDA  COUNT     ;At each point plotted, the count         A5 MC
          SBC  DX,X      ;goes down by the lesser of DX or DY      F5 M8
          STA  COUNT     ;                                         85 MC
          LDA  COUNT+1   ;                                         A5 MD
          SBC  DX+1,X    ;                                         F5 M9
          STA  COUNT+1   ;                                         85 MD
          DRA  COUNT     ;Test count.                              05 MC
          BEQ  INCCMP    ;If count =< 0 then step the coord        F0 07
          BCC  INCCMP    ;with lesser difference.                  90 05
          DEX            ;Else test which is control coord         CA
          BPL  INCCTX    ;(stepped every time) and go inc x        10 17
          BMI  INCCTY    ;or step (inc or dec) y.                  30 24
;
INCCMP    LDX  AXIS      ;Using x or y index,                      A6 MF
          CLC            ;prepare to add,                          18
          LDA  CDUNT     ;and add greater of DX or DY to           A5 MC
          ADC  DX,X      ;count that has gone below 1.             75 M8
          STA  COUNT     ;                                         85 MC
          LDA  COUNT+1   ;                                         A5 MD
          ADC  DX+1,X    ;                                         75 M9
          STA  COUNT+1   ;Test which is complementary coord        85 MD
          DEX            ;(stepped only when count incremented)    CA
          BPL  INCCPX    ;and inc comp-x then control-y,           10 0C
          JSR  INCRY     ;or comp-y then control-x.                20 lo hi
;
INCCTX    INC  STRX      ;Inc every iteration when                 E6 M0
          BNE  LOOP      ;DX > DY                                  D0 BA
          INC  STRX+1    ;then loop back to plot point             E6 M1
          JMP  LOOP      ;and repeat until end of line.            4C lo hi
;
INCCPX    INC  STRX      ;Inc only when count adjusted             E6 M0
          BNE  INCCTY    ;(since DX =< DY)                         D0 02
          INC  STRX+1    ;then ...                                 E6 M1
;
INCCTY    JSR  INCRY     ;Inc every iteration (DX =< DY) and       20 lo hi
          JMP  LOOP      ;repeat, plotting point, until end.       4C lo hi
;
;...Local subroutine to increment/decrement y coordinate.
;
INCRY     LDA  #1        ;Inc or dec y coordinate by adding YA.    A9 01
          LDY  STEP      ;Set lo-byte A = 1 for inc and get        A4 ME
          BEQ  ADD       ;hi-byte Y. If hi-byte Y negative then    F0 02

          LDA  #$FF      ;set A = $FF, YA = -1, for dec.           A9 FF
ADD       CLC            ;Prepare to add 1 or -1 to y coordinate.  18
          ADC  STRY      ;Add lo-byte                              65 M2
          STA  STRY      ;                                         85 M2
          TYA            ;and                                      98
          ADC  STRY+1    ;hi-byte,                                 65 M3
          STA  STRY+1    ;addressing next point on line.           85 M3
          RTS            ;Return to main routine.                  60
;
EXIT      PLP            ;Restore flags                            28
          RTS            ;and exit main routine, line drawn.       60
;
```

USER GROUPS INDEX

Below is a list of updates and additions to the full User Group Index published in the January issue of APC. The next full listing will appear in the June issue of APC.

NSW

The Nowra Apple User Group meets on every third Monday of each month commencing at 7.30 pm. The venue is the Nowra High School computer room (F block), Moss Street, Nowra. For more details contact the Nowra Apple User Group's Secretary, Mr C Hayman, 48 Salisbury Drive, Nowra, NSW 2541.

An Apple IIGS User Group has recently been formed. Interested readers should contact Terry Cass on (02) 688 2701 or write to PO Box 210, Wentworthville, NSW 2145.

An Amstrad and TRS-80 User Group has recently been formed. For more details write to Craig Tollis, PO Box 584, Port Macquarie, NSW 2444.

Vic

The Central Victoria United Computer Club meets at 7.30 pm on the first Friday of each month at 21 Carpenter Street, Quarry Hill. All computers are catered for. For more details write to Larry Combridge, PO Box 14, Cal Gully, Vic 3556.

Qld

The Brisbug User Group has a new mailing address. All future correspondence should go to: PO Box 985, Toowong, Qld 4066.

WA

The correct address for the Vic-Ups Computer User Group (Incorporated) is: PO Box 178, Nedlands WA 6009.

END

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printers' errors, etc.

Dallas, Texas	APL'87 Contact: APL 87 Registrar 440 Northlake Shopping Centre Suite #210, Dallas, Texas US 75238	May 10-14, 1987
Perth	Ausgraph '87 Contact: Conference Secretariat PO Box 29, Parkville Vic 3052 (03) 387 9955	May 11-15, 1987
Melbourne	PC87-The Ninth Australian Personal Computer Show also incorporating Office Technology '87 and Communications '87 Contact: Ms F Michael Australian Exhibition Services Suite 3.3, 424 St Kilda Road Melbourne Vic 3004 (03) 264 4500	May 31-June 3, 1987
Atlanta	The Seventh Annual Comdex/Spring at the Georgia World Congress Centre in Atlanta Contact: (02) 959 5555	June 1-4, 1987
Chicago	NCC'87 Contact: American Federation of Information Processing Societies 1899 Preston White Drive, Reston, Virginia 2209 (703) 620 8955	June 15-18, 1987

NUMBERS COUNT

This month Mike Mudge tackles the many interesting computational problems associated with right-angled (otherwise known as Pythagorean) triangles.

A Pythagorean (or right-angled) triangle may be defined uniquely by giving the lengths, a and b, of its two shorter sides (the legs). The length, c, of the third and longest side (the hypotenuse) is then given by the formula $C^2 = a^2 + b^2$, this being an algebraic statement of the Theorem of Pythagoras (c570-500 BC).

The perimeter of such a triangle is

For example:
$a=119$, $b=120$, here:
$c=\sqrt{(119^2+120^2)}=169$,
$P=119+120+169=408$,
$A=\frac{1}{2}(119)(120)=7140$.

In everything that follows, a, b and c are restricted to be positive integers (whole numbers).

Problem (i) Find Pythagorean triangle such that the area plus the square of the sum of the legs is itself the square of an integer (1643).

Problem (ii) Find Pythagorean triangles such that the area plus the shorter leg is itself the square of an integer (1693).

Problem (iii) Find Pythagorean triangles such that the area plus the hypotenuse is itself the square of an integer (1676).

Problem (iv) Find *at least two* triples of Pythagorean triangles such that each member of a triple has the same perimeter while the areas of the members of a triple are in arithmetic progression (by which we mean that the difference between the two larger areas is equal to the difference between the two smaller areas — 1819).

Problem (v) Find *all* quadruples of Pythagorean triangles having a common perimeter less than 10^6 within each quadruple (1950). (The dates in brackets following each problem indicate when a substantial, although not necessarily complete, solution appeared).

Readers are encouraged to send their thoughts, together with complete or partial attempts at the solutions to the above problems, to Mike Mudge, C/- *APC*, 2nd Floor, 215 Clarence Street, Sydney 2000, to arrive by 15 May 1987.

It would be appreciated if such submissions contained a brief summary of results together with thoughts relating to these problems, in a form suitable for future publication in *APC*.

Submissions will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a stamped addressed envelope is provided.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future 'Numbers Count' articles; replies to all letters will be answered in due course.

Review: October '86

The response to this problem was particularly disappointing; so much so that it is re-opened for submissions by 15 May 1987.

Details of the problem are given in the October 1986 issue or in *Computers in Number Theory* (AOL Atkin and BJ Birch, Academic Press 1971).

It is concerned with s(n), the sum of all the positive integers which divide exactly into n, thus $s(98)=1+2+7+14+49+98=171$ and seeks solutions of $s(q)+s(r)=s(q+r)$. Many results are known for the case $q+r=p^2$ where p and q are prime and $r=2^{nk}2$ with n and k odd integers: k taking value 5, having been the subject of investigation by MJT Guy.

END

LAZING AROUND

Brain-teasers provided by JJ Clessa.

PRIZE PUZZLE

A certain club organises an annual charity drive among its members as follows:

Two charities are nominated and each club member must vote for one or the other. When all the votes have been counted, each member is asked to donate to his chosen charity as many dollars as that charity received votes.

This year's charity drive was the 10th year in succession and each year the club membership has increased. There are now nearly 300 members.

By a remarkable coincidence, on every charity drive to date, the difference in donations made to the two charities has been exactly the same.

How many members are there at the moment?

Answers on postcards please, or backs of envelopes, to reach us not later than 30 April 1987. Send your entries please to *APC*, Prize Puzzle April, 2nd Floor, 215 Clarence Street, Sydney 2000.

PRIZE PUZZLE JANUARY '87

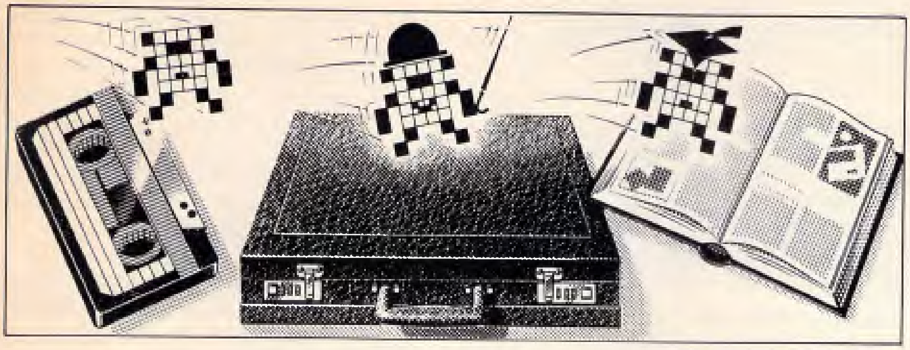
A very low response to our puzzle about the marbles. Perhaps it was more difficult than usual.

Anyway, the correct answer was 'Blue' and the winning entry this month came from Mr R Lockwood of Ferny Hills, Qld who receives our congratulations, and who will shortly also receive his prize.

Keep puzzling.

END

PROGRAM FILE



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Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the box below.

APC is interested in programs written in any of the major programming languages from all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work. We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped, self addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of $20 per page of published listing.

Send your contributions to APC Programs, Att. Stephen Crowley, 77 Glenhuntly Rd, Elwood 3184.

Last month, I stated that I would be starting a new algorithm section in this month's Program File. I had intended to use Modula-2 and pseudocode for any program code I needed to list, but decided to use Modula-2 and a simple version of Basic. This should make the ideas accessible to as many people as possible, and the combination should make it easy to convert the algorithms to other languages.

Readers should contribute to this section, and I would like to receive ideas for forthcoming issues. Improvements on previously published algorithms will be accepted, although they will not be given priority in Program File. If anyone wants to have a go at writing about a programming technique or algorithm, please stick to the format and style I have used here.

Linked lists

To start things off gently, I'll take a look at linked lists — what to use them for, how to implement them — and present some basic operations. In structured languages which have several data types, lists are easy to implement since they are seldom explicitly supported. In languages like Basic, they are not supported and some kind of system to build them is necessary.

The object of the exercise is to set up and use a data structure for a computer, that works in the same way as people's ideas of a list. It should hold items in order and make it easy to delete or add items without moving anything, just by putting them in position.

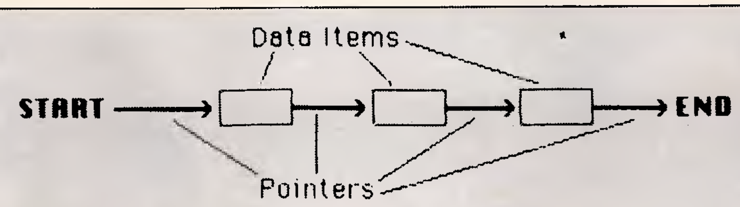

Fig 1 A simple singly-linked list

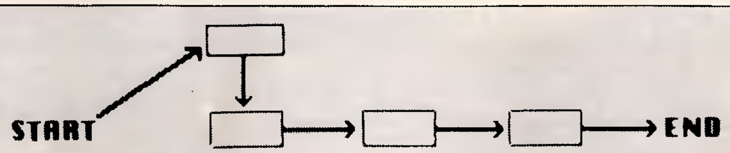

Fig 2 A singly-linked list with a new data item inserted between the start and the first data item. Only pointers have to be changed

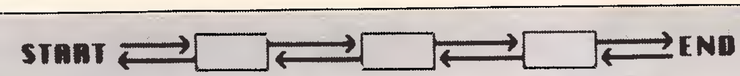

Fig 3 A doubly-linked list

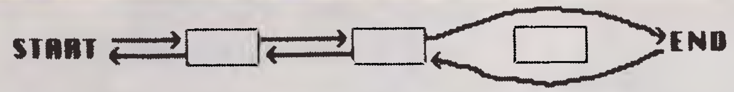

Fig 4 A doubly-linked list with pointers moved to delete the third item

The standard way in which computers hold items of information is sequentially or one after another in memory. If you want to add a new piece of information it can either go on the end — probably in the wrong place — or you have to move all the other bits of information to make room. A computer-based linked list does away with the need for this by associating extra information with each item (Fig 1). When a new piece of information is added, although it is physically placed after all the old bits, it is treated as if it were in the proper place (Fig 2).

Linked lists can be made more flexible and easy to use by having two pointers for each item: one showing where the next item is; and one showing where the previous item in the list is. This makes it easier to find things in the list and manipulate the data in different ways (Fig 3).

Advantages

The main advantage of lists is that they make it much easier to add and delete information. This is useful in word processors where new information is constantly being added in different places, and other information is being deleted. Here, this kind of operation is more important than a slight loss of storage space. For example, when deleting a line of text with lists, all that has to be done is to change two pointer values (Fig 4). In standard sequential storage, *all* the following lines would have to be moved backwards to fill in the gap, which takes much longer.

To use list structures on the computer, we need to store the ordinary data items — strings, say — and the links or pointers. The ordinary data items can be stored in the usual way. The links or pointers need to be connected to the data items, as they tell the computer where to go to find the next item. They can be integers.

Structured languages like Pascal, Modula-2 or C, which have many data types built into the language, already have the necessary data structures to make linked lists; all that's needed is to organise them correctly. Other languages, such as Basic, do not have these data structures so they must be simulated in some way. The best way is to use several arrays. The data items are held in a suitable array (or arrays), in this case an array of strings. This should be large enough to hold the maximum amount of data. The pointers can then be created by using two integer arrays of the same size. Each corresponding element of the arrays makes up one element of the linked list.

All that we now need to do is to define certain preset values for start and end links, and nulls, which lets us find empty elements and the start and end of the list easily. For simplicity, we can define a special value to hold the start pointer; the end pointer can be indicated by a null. An end-of-list pointer is needed (Fig 5).

When a new element is inserted in the list, the data is stored *after* all the old elements in the array, but is in the right place in the list. If you follow the pointers in Fig 6, the item has been put in the correct place in the list simply by adjusting the pointers. The START pointer points to element 0 which is the first item in the list. This in turn points forward to the NEW item, element 2, which points to the previous next item, element 1. This is still the last item in the list. Although the data has been put at the end in the array, the pointers make sure that it's in the correct place in the list.

The commented versions of the listings are in simple Basic (Listing 1) and are also given as simple proce-

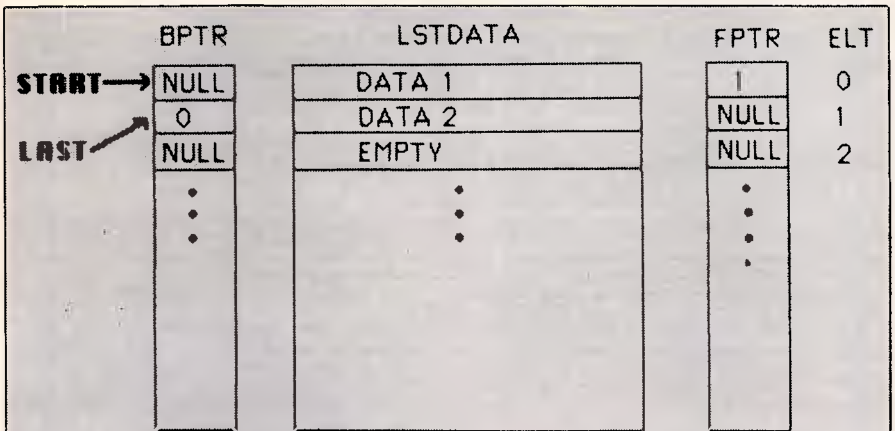

Fig 5 An array implementation of a list with two elements

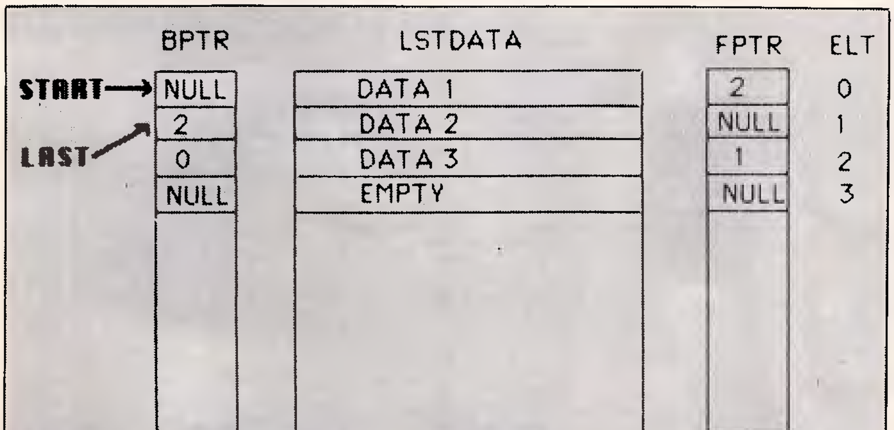

Fig 6 The array implementation in Fig 5 after the insertion of a new data item at position 1

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dures in Modula-2 (Listing 2). Neither of these has been optimised, and both could be polished up and improved — you can do this when you understand the basic principles. Since Modula-2 already has support for lists it's easy to improve on these procedures, but I have deliberately made them as similar as I can to the Basic versions. The REM statements have been included for ease of understanding and don't really conform properly to Basic syntax — don't type any of them in.

I have used these procedures as the basis for a simple telephone-book program. The advantage of lists here is that it's very easy to insert a new name and number in the correct place without moving all the other data items. The program takes a single letter command — I, D, F, for insert, delete and find — followed by a name, or a name and number.

I would welcome comments, letters, improvements, and so on, on these routines since they are only intended to start the ball rolling.

Listing 1 Commented versions in simple Basic

```
10 DIM FPTR(50), BPTR(50), LSTDTAN$(50), LSTDTAT$(50)
   REM/Set up arrays to hold data and pointers
20 GOSUB 4000
   REM/Initialise variables and arrays
30 INPUT "COMMAND: ";CMND$
40 IF CMND$="I" THEN 100
50 IF CMND$="D" THEN 200
60 IF CMND$="F" THEN 300
70 GOTO 30
   REM/Main part of program - gets command, calls a processing
   REM/routine and loops round indefinitely.

100 INPUT"ENTER NAME: ";NME$
110 INPUT"ENTER NUMBER: ";NMBR$
120 DVL1$=NME$: DVL2$=NMBR$: GOSUB 3000
130 GOTO 30
    REM/Input routine - gets name and number, puts them into
    REM/variables for the Append routine, calls it and returns
    REM/to the main program

200 INPUT"ENTER NAME: ";NME$
210 DVL1$=NME$: GOSUB 5000
220 IF INDEX=NULL THEN PRINT"NOT FOUND...": GOTO 30
230 ITEMNO=INDEX: GOSUB 1000: GOTO 30
    REM/Delete routine - gets name to delete, checks it is there
    REM/by calling Find (line 210). If not, say so and return,
    REM/otherwise set variable for Delete, call it and return.

300 INPUT"ENTER NAME: ';NME$
310 DVL1$=NME$: GOSUB 5000
320 IF INDEX=NULL THEN PRINT"NOT FOUND...": GOTO 30
330 PRINT"FOUND...";LSTDTAT$(INDEX): GOTO 30
    REM/Find routine - gets name, puts in variables and calls
    REM/Find. If it isn't there, Find returns NULL in INDEX, a
    REM/message is printed; if it is, then print a message and
    REM/get the corresponding number and print it.

REM------------------------------------------------------------
REM The following routines are the general list processing
REM routines. They have been modified to work with two strings
REM as the data elements. The data elements, held in LSTDTAN$
REM and LSTDTAT$, can be changed to whatever your application
REM needs.
REM------------------------------------------------------------

1000 REM/ DELETE(ITEMNO)
1010 IF ITEMNO=LAST THEN LAST=BPTR(ITEMNO): FPTR(ITEMNO)=NULL:
     FPTR(BPTR(ITEMNO))=NULL: BPTR(ITEMNO)=NULL: GOTO 1040
     REM/Deal with special case if the item being deleted is the
     REM/last one. Make LAST which points to the last element in
     REM/list, point to the previous item. Set the FPTR and BPTR
     REM/of the item to NULL so that the routines know the item
     REM/is empty and set the FPTR of the previous item to NULL
     REM/(denoting the new last item).
1020 IF ITEMNO=START THEN BPTR(FPTR(ITEMNO))=0: BPTR(ITEMNO)=NULL:
     START=FPTR(ITEMNO): FPTR(ITEMNO)=NULL: GOTO 1040
     REM/Similarly for the special case of the first item. The
     REM/major difference is that the BPTR of the next item,
     REM/which is to become the new start item, is set to 0 as a
     REM/special marker value for the front of the list. This is
     REM/necessary in Basic since the program has to do all its
     REM/own housekeeping, unlike structured languages.
1030 BPTR(FPTR(ITEMNO))=BPTR(ITEMNO): FPTR(BPTR(ITEMNO))=FPTR(ITEMNO):
     BPTR(ITEMNO)=NULL: FPTR(ITEMNO)=NULL
     REM/This line deals with the general case and simply sets
     REM/pointers to pass around the item and also sets the
     REM/item's pointers to NULL so that the program knows that
     REM/the space can be re-used.
1040 RETURN

2000 REM/ INSERT(ITEMNO,DVAL)
2010 GOSUB 6000: REM/ FINDFREE
     REM/Find a free space to insert the item in
2020 IF FAIL=1 THEN GOSUB 7000: RETURN: REM/ IF FAIL THEN ERROR
     REM/If no space then report an error and return
2030 IF (START=NULL OR ITEMNO=START) THEN BPTR(ITEMNO)=FREE:
     BPTR(FREE)=0: LSTDTAN$(FREE)=DVL1$: LSTDTAT$(FREE)=DVL2$:
     FPTR(FREE)=START: START=FREE: GOTO 2050
     REM/This line deals with the special case when the item is
     REM/to be inserted at the start. This needs a lot of care
     REM/because the program has to look after all the pointers
     REM/correctly. In Pascal, C or Modula-2, the pointers can
     REM/look after themselves. Once again, the special marker
     REM/for the BPTR of the first item in the list is used.
2040 BPTR(FREE)=BPTR(ITEMNO): FPTR(FREE)=ITEMNO:
     FPTR(BPTR(ITEMNO))=FREE: BPTR(ITEMNO)=FREE:
     LSTDTAN$(FREE)=DVL1$: LSTDTAT$(FREE)=DVL2$
     REM/The general case of insertion - it simply puts the data
     REM/values in the data part of the list and shuffles the
     REM/pointers about correctly.
2050 RETURN

3000 REM/ APPEND(DVAL)
3010 GOSUB 6000: REM/ FINDFREE
     REM/Find a free space to put the new element in
3020 IF FAIL=1 THEN GOSUB 7000: RETURN: REM/ IF FAIL THEN ERROR
     REM/If failed the report an error
3030 FPTR(LAST)=FREE: BPTR(FREE)=LAST: LAST=FREE:
     LSTDTAN$(FREE)=DVL1$: LSTDTAT$(FREE)=DVL2$
     REM/This is a special case of Insert where the item gets
     REM/placed on the end of the list only. Because of this,
     REM/the pointers don't need to be altered so much.
3040 RETURN

4000 REM/ INITIALISE
4010 NULL=-1: START=NULL: LAST=0: INDEX=0: ITEMNO=0: FAIL=0
4020 FOR I=0 TO 50: BPTR(I)=NULL: FPTR(I)=NULL: NEXT I
4030 RETURN
     REM/This sets up the variables before using the list. All
     REM/the pointers need to be set correctly, in this case to
     REM/NULL or 0.
5000 REM/ FIND(DVAL,INDEX)
5010 INDEX=START
     REM/Set the index pointer to the top of the list
5020 IF (FPTR(INDEX)=NULL AND BPTR(INDEX)=NULL) THEN INDEX=NULL
     : RETURN
     REM/If the first item is empty then can't find it
5030 IF LSTDTAN$(INDEX)=DVL1$ THEN RETURN
     REM/If the item matches, then return with INDEX holding
     REM/the item number
```

```
5040 IF FPTR(INDEX)=NULL THEN INDEX=NULL: RETURN
     REM/If it is the last item then it wasn't there, return
     REM/INDEX with NULL to show it.
5050 INDEX=FPTR(INDEX): IF INDEX<51 THEN 5030
     REM/Move down the list and check for an error (shouldn't
     REM/ever occur)
5060 INDEX=NULL: RETURN


6000 REM/ FINDFREE(FREE)
     REM/Find a free space in the array in which to insert the
     REM/next item.
6010 I=0: FAIL=0: FREE=NULL
     REM/Set up pointers and counter values. This ISN'T a list
     REM/processing routine. It is a housekeeping routine to
     REM/find space for the next element in the list. This is
     REM/dealt with automatically in languages that have list
     REM/data types.
6020 IF (FPTR(I)=NULL AND BPTR(I)=NULL) THEN FREE=I: RETURN
     REM/If array element empty, then allocate FREE pointer
     REM/to it.
6030 I=I+1: IF I>50 THEN FAIL=1: RETURN
     REM/Continue on if not empty, if reach the end then return
     REM/fail flag.
6040 GOTO 6020

7000 REM/ ERROR
7010 PRINT"LIST SPACE RUN OUT. YOU ARE USING TOO MANY"
7020 PRINT"ITEMS. CHANGE ARRAY SIZES..."
7030 RETURN
```

Listing 2 Uncommented versions as simple procedures in Modula-2

```
TYPE
     ListIndex = POINTER TO DataElement;
     DataElement = RECORD
                    DataValue: String;
                    Fptr,Bptr: ListIndex
                    END;

VAR
     Start,Last,Index,ItemNo,Free: ListIndex;
     Fail: Boolean;

PROCEDURE Delete(ItemNo: ListIndex);
BEGIN
     IF ItemNo=Last THEN
          Last:=ItemNo^.Bptr;ItemNo^.Bptr^.Fptr:=NIL
     ELSEIF
          IF ItemNo=Start THEN
               Start:=ItemNo^.Fptr;ItemNo^.Fptr^.Bptr:=NIL
          ENDIF
     ELSEIF
          ItemNo^.Fptr^.Bptr:=ItemNo^.Bptr;
          ItemNo^.Bptr^.Fptr:=ItemNo^.Fptr;
     ENDIF
     Deallocate(ItemNo,SIZE(DataElement))
END Delete;

PROCEDURE Insert(ItemNo: ListIndex; Dval: String);
BEGIN
     FindFree;
     IF Fail THEN Error
     ELSEIF
          IF ItemNo=Start THEN
               ItemNo^.Bptr:=Free;Free^.DataValue:=Dval;
               Free^.Fptr:=Start;Free^.Bptr:=NIL;Start:=Free
          ENDIF
     ELSEIF
               Free^.Bptr:=ItemNo^.Bptr;Free^.Fptr:=ItemNo^.Bptr^.Fptr;
               ItemNo^.Bptr^.Fptr:=Free;ItemNo^.Bptr:=Free;
               Free^.DataValue:=Dval
          ENDIF
     END Insert;

     PROCEDURE Append(Dval: String);
     BEGIN
          FindFree;
          IF Fail THEN Error
          ELSEIF
               Last^.Fptr:=Free;Free^.Bptr:=Last;last:=Free;

               Free^.DataValue:=Dval
          ENDIF
     END Append;


     PROCEDURE Initialise;
     BEGIN
          Start:=NIL;Last:=NIL;ItemNo:=NIL;Index:=NIL;Free:=NIL
     END Initialise;
     PROCEDURE Find(Dval: String; VAR Index: ListIndex);
     BEGIN
          Index:=Start;
          WHILE(Index^.Fptr<>NIL OR Index^.DataValue<>Dval) DO
               Index:=Index^.Fptr END
     END Find;

     PROCEDURE FindFree(VAR Free: ListIndex);
     BEGIN
          Allocate(Free,SIZE(DataElement))
     END FindFree;
```

C Background Routines

by G Baker

The idea behind this facility is to put a function into the background so that it only executes while no keys are being pressed. The functions in this example are assumed to be of type 'int', but type 'void' would be more useful as any other function can be cast to this type. Type int is used because some compilers do not use void types.

The function which puts another function on the 'background' list is assfpi(). xgetch() executes the background functions and also acts like the standard library routine getch().

assfpi() is called with two arguments — an address of a function and its priority. An example is shown in Fig 1.

Each time xgetch() is called, it goes into a loop which executes each function in turn until a key is pressed. Subsequent calls to xgetch() start executing from the function whose priority number is closest to zero (highest priority).

The functions should execute quickly and 'remember' what to do on subsequent calls, as they will be called time and time again until the desired action is completed. Called functions could remove themselves from the list when they have finished. Passing parameters to the background functions can be done via global variables.

Functions are knocked off the list by passing a NULL function pointer to assfpi(). It can be seen from assfpi() that the priority is an index into an array of function pointers. xgetch() simply tests this array for a

value and calls it if it finds one.

The definition 'define getch xgetch' in an include file or at the start of a program means that you don't have to change the code.

```
int c;                          /* Temporary storage */
int func1(), func2(); /* functions for the 'background' */
void assfpi();

assfpi (func1, 0);                    /* highest priority */
assfpi (func2, 1);                      /* next highest */
while ((c = xgetch()) !=3) {                     /* func1 and func2 will
                                                    be executed in
                                                    xgetch() */
/* body */

;

}
assfpi ((int (*) ())0), 0);                        /* Set to NULL to clear */
assfpi ((int (*)))0), 1);
/*   #define PIFNULL (int (*) )()0 makes life easier
  so the above becomes
  assfpi (PIFNULL,0);
  assfpi (PIFNUll,1);

*/
```

Fig 1

```
/* EXECFUN.C
        G.Baker 9/7/85

        Two routines.
        One to assign a function as a 'background' task
        and one to replace the statndard getch() function.

        void assfpi(int (*)(), int) assign a function as a 'background
                                    function
        xgetch() replaces getch()

        Could bung
        #define getch xgetch
        in .H file
*/

#define NFUNCS 10                /* Max functions in 'background' */
#define PIFNULL (int (*)())0     /* short hand. NULL pointer */

static int (*xfptr[NFUNCS])();  /* Function pointers stored here.
                                    Am assuming compiler initialises
                                    static items to zero bytes.
                                */

void assfpi(fp,i)          /* assign integer function pointer */
int (*fp)();               /* address of function */
int i;                     /* Priority. 0=highest, NFUNCS-1 = lowest */
{
        xfptr[i % NFUNCS] = fp;
}

xgetch()          /* replaces getch(). execute functions untill key pressed */
{
```

```
        /* kbhit() is a library routine which returns non-
           zero if a key has been pressed */
int i, kbhit();

for (i = 0;kbhit() == 0;i = ++i % NFUNCS)
        if (xfptr[i] != PIFNULL)
                (*xfptr[i])();
return(getch());
```

Turbo Prolog Mouse Sketch

by David Pletts

This program and set of routines allow the Microsoft Mouse to work with Turbo Prolog. A demonstration program to make simple sketches is included. To use the program, you will need an IBM or clone with CGA, a Microsoft Mouse or equivalent, and Turbo Prolog.

Turbo Prolog provides a standard predicate, bios, which allows access to system interrupts. A number of mouse functions are available through INT 51 (33 in hexadecimal), and the following predicates use this interrupt to access the functions needed for the program.

mstatus (Status, Buttons) — resets the mouse parameters and returns the mouse status. Status returns 0 if the mouse has not been installed, −1 otherwise. Buttons returns the number of buttons in operation, which is two for the Microsoft Mouse. This function could be used to exit the program with an appropriate message if the mouse has not been installed.

mshow — turns the mouse pointer on.

mhide — turns the mouse pointer off.

mpos (Button, Xpos, Ypos) — Button returns 1 if the left button has been pressed, 2 if it's the right. Xpos and Ypos returns the current coordinates of the mouse pointer.

mshape — works in conjunction with the shape predicate to define the shape of the mouse pointer. The second and third bios arguments (4 and 7) define the pointer's hot spot. The next argument gives the segment for the place in memory where the pointer shape information may be found ($F1F40), with the final argument providing the offset value ($0800).

shape — uses the standard predicate 'memword' to store the information for the pointer shape in an unused area of memory provided when the CGA has been installed.

The program is provided with an internal goal, which means that it will begin to search for a solution to the goal as soon as it starts running. The first task is to clear the text window; next, the standard predicate graphics (2,1,15) selects hi-res mode. The next predicate, border, draws a border on the screen and places some text on the bottom of the line.

To use the sketch program, press the right mouse button at the start of a line and the left button at the end. Pressing the left button again will draw a line from the place the left button was last pressed. Press the right-hand button to start a new line or produce a single dot.

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```
/* PROLOG MOUSE SKETCH */

predicates

mstatus(integer,integer)
mshow
mhide
mpos(integer,integer,integer)
mshape
shape
border
move(integer,integer,integer)
checkbutton(integer,integer,integer,integer,
integer,integer,integer,integer,integer)

goal    clearwindow,graphics(2,1,15),
        border,
        mstatus(_,_),
        shape,mshape,
        mshow,mpos(_,X,Y),move(X,Y,1).

clauses

mstatus(Status,Buttons) :-
        bios($33,reg(0,0,0,0,0,0,0,0),reg(Status,Buttons,_,_,_,_,_,_)).

mshow :-
        bios($33,reg(1,0,0,0,0,0,0,0),reg(_,_,_,_,_,_,_,_)).

mhide :-
        bios($33,reg(2,0,0,0,0,0,0,0),reg(_,_,_,_,_,_,_,_)).

mpos(Button,Xpos,Ypos) :-
        bios($33,reg(3,0,0,0,0,0,0,0),reg(_,Button,Xpos,Ypos,_,_,_,_)).

mshape :-
        bios($33,reg(9,7,4,$1F40,0,0,0,$0800),reg(_,_,_,_,_,_,_,_)).

shape :-
        memword($0800,$1F40,$FC3F),
        memword($0800,$1F42,$FC3F),
        memword($0800,$1F44,$FC3F),
        memword($0800,$1F46,$FFFF),
        memword($0800,$1F48,$03C0),
        memword($0800,$1F4A,$FFFF),
        memword($0800,$1F4C,$FC3F),
        memword($0800,$1F4E,$FC3F),
        memword($0800,$1F50,$FC3F),
        memword($0800,$1F52,$FFFF),
        memword($0800,$1F54,$FFFF),
        memword($0800,$1F56,$FFFF),
        memword($0800,$1F58,$FFFF),
        memword($0800,$1F5A,$FFFF),
        memword($0800,$1F5C,$FFFF),
        memword($0800,$1F5E,$FFFF),
        memword($0800,$1F60,$0000),
        memword($0800,$1F62,$0180),

        memword($0800,$1F64,$0180),
        memword($0800,$1F66,$0000),
        memword($0800,$1F68,$7C3E),
        memword($0800,$1F6A,$0000),
        memword($0800,$1F6C,$0180),
        memword($0800,$1F6E,$0180),
        memword($0800,$1F70,$0000),
        memword($0800,$1F72,$0000),
        memword($0800,$1F74,$0000),
        memword($0800,$1F76,$0000),
        memword($0800,$1F78,$0000),
        memword($0800,$1F7A,$0000),
        memword($0800,$1F7C,$0000),
        memword($0800,$1F7E,$0000).
```

```
border :-
        line(0,0,30399,0,1),
        line(30399,0,30399,31999,1),
        line(30399,31999,0,31999,1),
        line(0,31999,0,0,1),
        cursor(24,0), write("X:"),
        cursor(24,10), write("Y:"),
        cursor(24,20), write("BLACK"),
        cursor(24,30), write("WHITE"),
        cursor(24,40), write("CLEAR"),
        cursor(24,60), write("QUIT").

move(Xpos,Ypos,Col) :-
        mpos(B,X,Y),cursor(24,3),write(X,"   "),
        cursor(24,13),write(Y,"   "),
        checkbutton(B,X,Y,Xpos,Ypos,Xx,Yy,Col,Col1),move(Xx,Yy,Col1).

checkbutton(1,X,Y,Xput,Yput,Xput,Yput,C,C) :-
        Y > 189,
        X > 480, X < 512,
        mhide,text,exit.
checkbutton(1,X,Y,Xput,Yput,Xput,Yput,Colour,_) :-
        Y > 189,
        X > 160, X < 200,!,
        Colour = 0.
checkbutton(1,X,Y,Xput,Yput,Xput,Yput,Colour,_) :-
        Y > 189,
        X > 240, X < 280,!,
        Colour = 1.
checkbutton(1,X,Y,Xput,Yput,Xput,Yput,C,C) :-
        Y > 189,
        X > 320, X < 360,!,
        clearwindow,border.
checkbutton(1,X,Y,Xput,Yput,Xold,Yold,Colour,Colour) :-
        Xx = X * 50,Xold = X,
        Yy = Y * 160, Yold = Y,
        Xp = Xput * 50, Yp = Yput * 160,
        mhide,
        line(Yp,Xp,Yy,Xx,Colour),mshow.
checkbutton(2,X,Y,_,_,Xold,Yold,Colour,Colour) :-
        Xold = X, Yold = Y,

        Xx = X * 50,Yy = Y * 160,
        mhide,
        dot(Yy,Xx,Colour),
        mshow.
checkbutton(_,_,_,Xput,Yput,Xput,Yput,C,C).
```

Program of the Month
CPC Multi-Column Formatter
by Rudi Way

As Rudi Way cheekily mentioned in his covering letter, this program could be used to produce a computer magazine since it allows text to be printed in columns. The program is operated by a long menu which is used to set a wide range of options. Each option has a default value which can be selected by pressing Return.

There is an initialisation section which includes the printer control codes. These will have to be changed to fit in with your printer.

One problem the program has to deal with is what to do if the output doesn't fill the last page. In this case you are given the choice of having all the columns finish level with each other halfway down the page, or fill

the first columns and leave the latter ones empty.

The program allows for front and back pages. This switches page numbers and headings from side to side so that if they were organised in book form, the numbers and headings would always be on the edge.

The program is also capable of controlling fonts on different printers. It is set up to use standard Epson controls and can print in pica, elite, condensed, NLQ or condensed subscript. It has been carefully written and is modular, so it should be easy to understand and adapt.

```
200 '----------MAIN PROGRAM----------
210 DEFINT a-z
220 ON ERROR GOTO 470
230 ON BREAK GOSUB 340
240 GOSUB 5870 'defaults
250 GOSUB 5220 'initialisations
260 again=1
270 WHILE again
280    GOSUB 4810 'set up screen
290    GOSUB 1800 'user input
300    GOSUB 540  multi column output
310
320    GOSUB 2210 again ?
330 WEND
340 '
350 PEN 1:PAPER 0:MODE 2
360 LOCATE ( 80-LEN(message13$) )/2,12  PRINT message13$
370 INK 1,pencolour,papercolour
380 CLOSEIN:CLOSEOUT
390 dummy!=FRE("")
400 INK 1,pencolour
410 CLEAR
420 CLS
430 END
440 '--------------------------------
450
460
470 '----------ERROR ROUTINE----------
480 PEN 1:PAPER 0
490 MODE 2
500 PRINT "ERROR";ERR;"in line";ERL
510 END
520 '--------------------------------
530
540 '----------MAKE COLUMNS-----------
550 OPENIN infile$
560 IF (outfile$<>SCR$) AND (outfile$<>PRI$) THEN OPENOUT outfile$ ...
570 IF outfile$=SCR$ THEN str=2
580 IF outfile$=PRI$ THEN str=8
590 '
600 IF frobac=-1 THEN 630
610    storedlm=lm
620    storedrm=rm
630 'FI
640
650 IF pagnum<>0 THEN page=pagnum
660 '
670 WHILE NOT EOF
680 '  read a page
690    DIM lain$[nc,lpp] 'lain$[columns,lines per page'
700
710    FOR n=1 TO nc
720       FOR m=1 TO lpp
730          IF EOF THEN 810 'break
740          LINE INPUT#9,lain$[n,m]
750          PRINT      'erase  Loading.
760          lain$[n,m]=MID$(lain$[n,m],1,cw)
770          lain$[n,m]=lain$[n,m]+SPACE$(cw-LEN(lain$[n,m]))
780       NEXT
790    NEXT
800
810    write a page
820    IF str=2 THEN CLS#2
830
840    IF frobac=0 THEN lm=storedlm:rm=storedrm   front page
850    IF frobac=1 THEN lm=storedrm:rm=storedlm   back page
860
870    IF head=0 THEN 990  no header
880
890       IF frobac<>0 THEN hed$=LEFT$(SPACE$(lm)+header$,pw): GOTO 910
900          hed$=LEFT$( SPACE$( MAX( 0,pw-rm-LEN(header$)))+header$,pw)
910       FI
920
930       IF str<>2 THEN 960
940          PRINT#2,MID$(hed$,1,80)
950          IF LEN(hed$)<80 THEN PRINT#2
960       FI
970
980       IF str<>2 THEN PRINT#str,hed$:PRINT#str
990    FI
1000
1010   IF equ AND EOF THEN GOSUB 1640   move some lines on last page
1020 '
1030   FOR m=1 TO lpp
1040      IF lain$[1,m]="" THEN L$="":GOTO 1120  empty line
1050         L$=SPACE$(lm)
1060
1070         FOR n=1 TO nc-1
1080            IF lain$[n,m]<>"" THEN L$=L$+lain$[n,m]+SPACE$(cm
1090         NEXT
1100
1110         L$=L$+lain$[nc,m]
1120 '    FI
1130
1140      IF str<>2 THEN 1170
1150         PRINT#2,MID$(L$,1,80) ;
1160         IF LEN(L$)<80 THEN PRINT#2
1170      FI
1180
1190      IF str<>2 THEN PRINT#str,L$: PRINT      erase  Sa...
1200   NEXT
1210
1220   ERASE lain$
1230
1240   IF pagnum=0 THEN 1480  no page numbering
1250      PRINT#str
1260
1270      IF frobac<>-1 THEN 1300
1280         page$=SPACE$( MAX( 0,( pw-4-LEN( STR$(page) ) )/2 ) )
1290         page$=LEFT$( pages + "- " + STR$(page) + " -" ,pw )
1300      FI
1310
1320      IF frobac<>0 THEN 1350
1330         page$=SPACE$( MAX( 0,pw-rm-LEN(STR$(page) ) ) )
1340         page$=LEFT$( page$ + STR$(page) , pw )
1350      FI
1360
1370      IF frobac=1 THEN page$=LEFT$(SPACE$(lm-1)+STR$(page),pw)
1380
1390      IF str<>2 THEN 1420
1400         PRINT#2,MID$(page$,1,80) ;
1410         IF LEN(page$)<80 THEN PRINT#2
1420      FI
1430
1440      IF str<>2 THEN PRINT#str,page$
1450
1460      page=page+1
1470
1480   FI
1490 '
1500   IF frobac<>-1 THEN frobac= (frobac+1) MOD 2
1510   IF str=2 THEN PRINT message4$:GOSUB 4690:PRINT:CLS#2
1520   IF str=8 THEN GOSUB 1590 'send formfeed
1530   IF str=9 THEN FOR m=lpp+1 TO pll-head+(pagnum<>0)*2:PRINT#9:NEXT
1540 '
1550 WEND
1560 CLOSEIN:CLOSEOUT
1570 RETURN
1580 '
1590 '---formfeed handling---
1600 FOR m=lpp+1 TO pll-head+(pagnum<>0)*2:PRINT#8:NEXT
1610 IF single AND NOT EOF THEN PRINT message6$:GOSUB 4690  wait for key press
1620 RETURN
1630 '
1640 '---move lines if equal height columns required---
1650 IF m=lpp+1 THEN n=n-1:m=lpp ELSE m=m-1
1660 lyncntr=(n-1)*lpp+m
1670 FOR col=nc TO 1 STEP -1
1680    li=lyncntr\col
1690    lyncntr=lyncntr-li
1700    FOR row=li TO 1 STEP -1
1710       lain$[col,row]=lain$[n,m]
1720       IF (col<>n) OR (row<>m) THEN lain$[n,m]=""
1730       m=m-1
1740       IF m=0 THEN n=n-1:m=lpp
1750    NEXT
1760 NEXT
1770 RETURN
1780 '------END OF MAKE COLUMNS-------
1790 '
1800 '------------- INPUT -------------
1810 again=1
1820 WHILE again
1830    GOSUB 3480 'input file
1840    GOSUB 3600 'output file
1850    GOSUB 2290 'number of columns
1860    GOSUB 2380 'column width
1870    GOSUB 2470 'left margin
1880    GOSUB 2560 'central margins
1890    GOSUB 2660 'right margin
1900    GOSUB 2750 'equal height columns ?
1910    GOSUB 2860 'header footer
1920    GOSUB 3020 'page numbers
1930    GOSUB 3100 'front back pages
1940    GOSUB 3340 'page length
1950    GOSUB 3200 'lines per page
1960    GOSUB 3760 'characterfont
1970    GOSUB 3870 'single sheet
```

```
1980
1990    GOSUB 2030  again ?
2000 WEND
2010 RETURN
2020 '
2030 '---rerun input---
2040 WHILE INKEY$<>"":WEND
2050 pw!= lm + nc*cw + (nc-1)*cm + rm   'page width
2060 IF pw!<256 THEN 2130
2070    SOUND 129,20
2080    PRINT message11$ ;
2090    again-1
2100    GOSUB 4690 'keypress
2110    PRINT
2120    RETURN
2130 'FI
2140 pw-pw!
2150 PRINT message10$ ;
2160 set$-yesno$:GOSUB 4150 'yes or no
2170 IF ndf-0 THEN tezt$-LEFT$(yesno$,1)
2180 again- ( tezt$-LEFT$(yesno$,1) )
2190 RETURN
2200 '
2210 '---rerun program---
2220 WHILE INKEY$<>"":WEND
2230 PRINT message14$ ;
2240 set$-yesno$:GOSUB 4150 'yes or no
2250 IF ndf-0 THEN tezt$-LEFT$(yesno$,1)
2260 again- ( tezt$-LEFT$(yesno$,1) )
2270 RETURN
2280 '
2290 '---number of columns---
2300 WINDOW#1,20,60,8,8:CLS#1:PRINT#1,s3$;nc ;
2310 PRINT inpu1$ ; :posi-POS(#0):GOSUB 4000
2320 WHILE ndf AND (tezt<-0 OR tezt>255):SOUND 129,20:GOSUB 4000:WEND:PRINT
2330 IF ndf THEN nc-tezt 'ndf- not default (number entered)
2340 LOCATE#2,2,8:PRINT#2,SPACE$(78)
2350 LOCATE#2,20,8:PRINT#2,s3$;nc
2360 RETURN
2370 '
2380 '---column width---
2390 WINDOW#1,20,60,9,9:CLS#1:PRINT#1,s4$;cw ;
2400 PRINT" 0 < ";inpu$;" < 256 : " ; :posi-POS(#0):GOSUB 4000
2410 WHILE ndf AND (tezt<-0 OR tezt>255):SOUND 129,20:GOSUB 4000:WEND:PRINT
2420 IF ndf THEN cw-tezt
2430 LOCATE#2,2,9:PRINT#2,SPACE$(78)
2440 LOCATE#2,20,9:PRINT#2,s4$;cw
2450 RETURN
2460 '
2470 '---left margin---
2480 WINDOW#1,20,60,10,10:CLS#1:PRINT#1,s5$;lm ;
2490 PRINT inpu2$ , :posi-POS(#0):GOSUB 4000
2500 WHILE ndf AND (tezt>255):SOUND 129,20:GOSUB 4000:WEND:PRINT
2510 IF ndf THEN lm-tezt
2520 LOCATE#2,2,10:PRINT#2,SPACE$(78)
2530 LOCATE#2,20,10:PRINT#2,s5$;lm
2540 RETURN
2550 '
2560 '---central margin (between columns)---
2570 IF nc-1 THEN RETURN
2580 WINDOW#1,20,60,11,11:CLS#1:PRINT#1,s6$;cm ,
2590 PRINT inpu2$ , :posi-POS(#0):GOSUB 4000
2600 WHILE ndf AND (tezt>255):SOUND 129,20:GOSUB 4000:WEND:PRINT
2610 IF ndf THEN cm-tezt
2620 LOCATE#2,2,11:PRINT#2,SPACE$(78)
2630 LOCATE#2,20,11:PRINT#2,s6$;cm
2640 RETURN
2650 '
2660 '---right margin---
2670 WINDOW#1,20,60,12,12:CLS#1:PRINT#1,s9$;rm ;
2680 PRINT inpu2$ ; :posi-POS(#0):GOSUB 4000
2690 WHILE ndf AND (tezt>255):SOUND 129,20:GOSUB 4000:WEND:PRINT
2700 IF ndf THEN rm-tezt
2710 LOCATE#2,2,12:PRINT#2,SPACE$(78)
2720 LOCATE#2,20,12:PRINT#2,s9$;rm
2730 RETURN
2740 '
2750 '---equal height columns ?---
2760 IF nc-1 THEN RETURN
2770 WINDOW#1,20,60,13,13:CLS#1:PRINT#1,s7$;equ$ ;
2780 PRINT message7$ ,
2790 set$-yesno$:GOSUB 4150 'yes or no
2800 IF ndf THEN equ$-tezt$
2810 equ-(equ$-LEFT$(yesno$,1))
2820 LOCATE#2,2,13:PRINT#2,SPACE$(78)
2830 LOCATE#2,20,13:PRINT#2,s7$;equ$
2840 RETURN
2850 '
2860 '---header---
2870 WINDOW#1,20,60,14,14:CLS#1:PRINT#1,s10$;head$ ,
2880 set$-yesno$
2890 PRINT message8$ ,
2900 GOSUB 4150 'header ?
2910 IF ndf THEN head$-tezt$
2920 LOCATE#2,2,14:PRINT#2,SPACE$(78)
2930 LOCATE#2,20,14:PRINT#2,s10$;head$
2940 IF head$-LEFT$(yesno$,1) THEN head-2 ELSE head-0:CLS#3:RETURN
2950 PEN#3,0:PAPER#3,1:CLS#3:PRINT#3,header$ ;
2960 PRINT  'erase message8
2970 LOCATE#3,1,1:LINE INPUT#3,"",tezt$
2980 IF tezt$<>"" THEN header$-tezt$
2990 PEN#3,1:PAPER#3,0:CLS#3:PRINT#3,header$ ,
3000 RETURN
3010 '
3020 '---page numbers---
3030 WINDOW#1,20,60,15,15:CLS#1:PRINT#1,s14$;pagnum
3040 PRINT message9$ ; :posi-POS(#0):GOSUB 4000:PRINT
3050 IF ndf THEN pagnum-tezt
3060 LOCATE#2,2,15:PRINT#2,SPACE$(78)
3070 LOCATE#2,20,15:PRINT#2,s14$;pagnum
3080 RETURN
3090 '
3100 '---front/back pages---
3110 WINDOW#1,20,60,16,16:CLS#1:PRINT#1,s15$;frobac$
3120 PRINT message12$ ;
3130 set$-frobacset$:GOSUB 4150
3140 IF ndf THEN frobac$-tezt$
3150 frobac-INSTR(frobacset$,frobac$)-2
3160 LOCATE#2,2,16:PRINT#2,SPACE$(78)
3170 LOCATE#2,20,16:PRINT#2,s15$;frobac$
3180 RETURN
3190 '
3200 '---lines per page---
3210 WINDOW#1,20,60,18,18:CLS#1:PRINT#1,s8$;lpp ,
3220 effpll-pll - head + 2*(pagnum<>0)
3230 PRINT"0 < ";inpu$;" <-";effpll;" : " ; :posi-POS(#0):GOSUB 4000
3240 WHILE (lpp>effpll AND NOT ndf) OR (ndf AND (tezt<-0 OR tezt>effpll))
3250    SOUND 129,20
3260    GOSUB 4000
3270 WEND
3280 PRINT
3290 IF ndf THEN lpp-tezt
3300 LOCATE#2,2,18:PRINT#2,SPACE$(78)
3310 LOCATE#2,20,18:PRINT#2,s8$;lpp
3320 RETURN
3330 '
3340 '---pagelength in lines---
3350 WINDOW#1,20,60,17,17:CLS#1:PRINT#1,s11$;pll ,
3360 minpll-head-(pagnum<>0) * 2
3370 PRINT inpu$;" >"; minpll;" : " ; :posi-POS(#0):GOSUB 4000
3380 WHILE (pll<-minpll AND NOT ndf) OR (ndf AND tezt<-minpll)
3390    SOUND 129,20
3400    GOSUB 4000
3410 WEND
3420 PRINT
3430 IF ndf THEN pll-tezt
3440 LOCATE#2,2,17:PRINT#2,SPACE$(78)
3450 LOCATE#2,20,17:PRINT#2,s11$;pll
3460 RETURN
3470 '
3480 '---input file---
3490 WINDOW#1,20,60,5,5:CLS#1:PRINT#1,s1$ ;
3500 IF infile$<>"" THEN PRINT#1,infile$ ; ELSE PRINT#1,empty$ ,
3510 PRINT message1$ , :GOSUB 4320 'get name
3520 IF ndf-0 THEN tezt$-infile$
3530 IF disc AND tezt$-"" THEN SOUND 129,20:GOTO 3510
3540 IF ndf THEN infile$-tezt$
3550 LOCATE#2,2,5:PRINT#2,SPACE$(78)
3560 LOCATE#2,20,5:PRINT#2,s1$ ,
3570 IF infile$<>"" THEN PRINT#2,infile$ ELSE PRINT#2,empty$
3580 RETURN
3590 '
3600 '---output file---
3610 WINDOW#1,20,60,6,6:CLS#1:PRINT#1,s2$ ,
3620 IF outfile$<>"" THEN PRINT#1,outfile$ ; ELSE PRINT#1, empty$ ;
3630 PRINT message2$ ; :GOSUB 4320 'get name
3640 IF ndf THEN t$-tezt$ ELSE t$-outfile$
3650 IF disc AND t$-"" THEN SOUND 129,20:GOTO 3630
3660 LOCATE#2,2,6:PRINT#2,SPACE$(78)
```

```
3670 LOCATE#2,20,6:PRINT#2,s2$ ;
3680 IF t$<>"" THEN PRINT#2,t$ ELSE PRINT#2,empty$
3690 IF disc=0 THEN outfile$=t$:RETURN
3700 IF (infile$<>tezt$) THEN outfile$=t$:RETURN
3710 IF tezt$=SCR$ OR tezt$=PRI$ THEN outfile$=t$:RETURN
3720 PRINT warning1$ ; 'equal filenames
3730 set$=yesno$:GOSUB 4150
3740 IF ndf=0 OR tezt$=RIGHT$(yesno$,1) THEN 3600 ELSE outfile$=t$:RETURN
3750 '
3760 '---choice of characterfont---
3770 IF outfile$<>PRI$ THEN RETURN
3780 WINDOW#1,20,60,19,19:CLS#1:PRINT#1,s12$;font
3790 PRINT message3$ ; :posi=POS(#0):GOSUB 4000
3800 WHILE ndf AND (tezt>maxfon):SOUND 129,20:GOSUB 4000:WEND:PRINT
3810 IF ndf THEN font=tezt
3820 IF font>0 THEN PRINT#8,pcode$[0];pcode$[font] ;
3830 LOCATE#2,2,19:PRINT#2,SPACE$(78)
3840 LOCATE#2,20,19:PRINT#2,s12$;font
3850 RETURN
3860 '
3870 '---single sheet---
3880 IF outfile$<>PRI$ THEN RETURN
3890 WINDOW#1,20,60,20,20:CLS#1:PRINT#1,s13$;single$
3900 PRINT message5$ ;
3910 set$=yesno$:GOSUB 4150
3920 IF ndf THEN single$=tezt$
3930 single=(single$=LEFT$(yesno$,1))
3940 LOCATE#2,2,20:PRINT#2,SPACE$(78)
3950 LOCATE#2,20,20:PRINT#2,s13$;single$
3960 RETURN
3970 '
3980 '---subroutines--- call --subroutines-- call -subroutines-
3990 '
4000 '--get number or reset not-default flag ndf--
4010 set$=NOS$+com$
4020 n=0
4030 tezt$=STRING$(3,nil$)
4040 i$=""
4050 WHILE i$<>cr$
4060    LOCATE posi,1:PRINT tezt$;SPACE$(3);
4070    GOSUB 4690 'i$=getchar
4080    IF ( INSTR(NOS$,i$) AND (n>=3) ) OR (i$=nil$) THEN SOUND 129,20
4090    IF INSTR(NOS$,i$) AND (n<3) THEN n=n+1:MID$(tezt$,n)=i$
4100    IF INSTR(clr$+del$,i$) THEN GOSUB 4760 'erase char
4110    IF i$=cr$ THEN ndf= ( tezt$<>STRING$(3,nil$) ):tezt= VAL(tezt$)
4120 WEND
4130 RETURN
4140 '
4150 '--get char from set + <cr> or reset not-default flag ndf--
4160 posi=POS(#0)
4170 i$=""
4180 tezt$=nil$
4190 set$=set$+com$
4200 WHILE i$<>cr$
4210    GOSUB 4690 'getchar
4220    IF i$=cr$ THEN 4270
4230    IF INSTR(com$,i$) OR i$=nil$ THEN tezt$=nil$
4240    IF i$=nil$ THEN SOUND 129,20
4250    IF INSTR(set$,i$) AND (INSTR(com$,i$)=0) THEN tezt$=i$
4260    LOCATE posi,1:PRINT tezt$;SPACE$(1) ;
4270 WEND
4280 ndf= (tezt$<>nil$)
4290 PRINT
4300 RETURN
4310 '
4320 '--get name--
4330 posi=POS(#0)
4340 good=0
4350 WHILE good=0
4360    n=0
4370    tezt$=STRING$(namelen,nil$)
4380    i$=nil$
4390    WHILE i$<>cr$
4400       IF slow THEN WHILE INKEY$<>"":WEND
4410       i$=nil$
4420       IF disc THEN LL=32 ELSE LL=31 'no spaces allowed , if disc
4430       WHILE NOT (INSTR(com$+tabb$,i$)<>0 OR (ASC(i$)>LL AND ASC(i$)<127))
4440          i$=INKEY$:WHILE i$="":i$=INKEY$:WEND
4450       WEND
4460       IF i$=tabb$ THEN tezt$="":ndf=-1:PRINT:RETURN 'empty name
4470       MID$(i$,1)=UPPER$(i$)
4480       IF INSTR(clr$+del$,i$) THEN GOSUB 4760:GOTO 4510
4490          IF n>=namelen AND i$<>cr$ THEN SOUND 129,20
4500          IF n<namelen AND i$<>cr$ THEN n=n+1:MID$(tezt$,n)=i$
4510       LOCATE posi,1:PRINT tezt$;SPACE$(namelen) ;
4520    WEND
4530    ndf= ( tezt$<>STRING$(namelen,nil$) )
4540    tezt$=LEFT$(tezt$,n)  'remove right side chr$(0)'s
4550    GOSUB 4600 'good = ( disc file name ok )
4560 WEND
4570 PRINT
4580 RETURN
4590 '
4600 '-check disc file name-
4610 IF disc = 0 THEN good = 1 : RETURN
4620 dot = INSTR(tezt$,".")
4630 IF INSTR(dot+1,tezt$,".") THEN 4660   'more than one dot
4640 IF dot = 0 THEN tezt$ = LEFT$(tezt$,8) : good = 1 : RETURN
4650 IF  (dot > 1) AND (LEN(tezt$)-dot <=3)  THEN good = 1 : RETURN
4660 LOCATE posi,1:PRINT SPACE$(namelen) ; :SOUND 129,20:good=0
4670 RETURN
4680 '
4690 '-get char from set$ or return nil-
4700 IF slow THEN WHILE INKEY$<>"":WEND
4710 i$=INKEY$: WHILE i$="": i$=INKEY$ :WEND
4720 MID$(i$,1)=UPPER$(i$)
4730 IF INSTR(set$,i$)=0 THEN i$=nil$
4740 RETURN
4750 '
4760 '-erase char-
4770 IF n>0 THEN MID$(tezt$,n)=nil$:n=n-1
4780 RETURN
4790 '-----------END OF INPUT---------
4800 '
4810 '---------SET UP SCREEN----------
4820 MODE 2:BORDER papercolour:INK 0,papercolour:INK 1,papercolour
4830 WINDOW#1,1,80,2,2:PEN#1,0:PAPER#1,1:CLS#1
4840 WINDOW#1,20,60,1,3:CLS#1
4850 LOCATE#1,8,2:PRINT#1,"- MULTI COLUMN  FORMATTER -" ,
4860 WINDOW#1,1,1,2,25:CLS#1
4870 WINDOW#1,80,80,2,25:CLS#1
4880 WINDOW#1,1,80,25,25:CLS#1
4890 PEN 1:PAPER 0
4900 LOCATE 20,8: PRINT s3$ ;nc
4910 LOCATE 20,9: PRINT s4$ ;cw
4920 LOCATE 20,10:PRINT s5$ ,lm
4930 LOCATE 20,11:PRINT s6$ ;cm
4940 LOCATE 20,12:PRINT s9$ ;rm
4950 LOCATE 20,13:PRINT s7$ ;equ$
4960 LOCATE 20,14:PRINT s10$;head$
4970 LOCATE 20,15:PRINT s14$;pagnum
4980 LOCATE 20,16:PRINT s15$;frobac$
4990 LOCATE 20,17:PRINT s11$;pll
5000 LOCATE 20,18:PRINT s8$ ;lpp
5010 LOCATE 20,19:PRINT s12$;font
5020 LOCATE 20,20:PRINT s13$;single$
5030 LOCATE 20,5 :PRINT s1$ ;infile$
5040 LOCATE 20,6 :PRINT s2$ ;outfile$
5050 WINDOW#0,2,80,25,25:PEN 0:PAPER 1           'command line
5060 WINDOW#2,1,80,1,24:PEN#2,1:PAPER#2,0         menu
5070 WINDOW#3,4,77,22,23:PEN#3,1:PAPER#3,0       'header
5080 MOVE  16,24
5090 DRAW 624,24,1
5100 DRAW 624,72
5110 DRAW  16,72
5120 DRAW  16,24
5130 MOVE  15,24
5140 DRAW  15,72
5150 MOVE 625,24
5160 DRAW 625,72
5170 IF head$=LEFT$(yesno$,1) THEN PRINT#3,header$ ;
5180 INK 1,pencolour
5190 RETURN
5200 '---------------------------------
5210 '
5220 '---------INITIALISATIONS---------
5230 AZ$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
5240 NOS$="0123456789"
5250 b$=CHR$(7)  'bell
5260 cr$=CHR$(13):tabb$=CHR$(9) 'carriage return, tab
5270 clr$=CHR$(16):del$=CHR$(127) 'clear, delete
5280 nil$=CHR$(0):esc$=CHR$(27)
5290 com$=clr$+del$+cr$
5300 IF disc THEN namelen=12 ELSE namelen=16
5310 '
5320 'printer control codes
5330 maxfon=5  'available number of fonts
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5340 DIM pcode$[maxfon]
5350 pcode$[0]=esc$+"@"           'printer reset
5360 pcode$[1]=esc$+"B"+CHR$(1)  'pica
5370 pcode$[2]=esc$+"B"+CHR$(2)  'elite
5380 pcode$[3]=esc$+"B"+CHR$(3)  'condensed
5390 pcode$[4]=esc$+"B"+CHR$(4)  'NLQ
5400 pcode$[5]=esc$+"S"+CHR$(1)+esc$+"A"+CHR$(6)+pcode$[3]  'condensed subscript
5410 '
5420 'translate these strings to your local language/dialect
5430 empty$="< no name >"
5440 SCR$="SCREEN"
5450 PRI$="PRINT"
5460 yesno$="YN"
5470 frobacset$="-FB"  'equal/front/back page
5480 inpu$="input"
5490 inpu1$="0 < input < 256 : "
5500 inpu2$="0 <= input < 256 : "
5510 s1$=" input file name: ":s1$=s1$+SPACE$(21-LEN(s1$))
5520 s2$=" output file name: ":s2$=s2$+SPACE$(21-LEN(s2$))
5530 s3$=" number of columns: ":s3$=s3$+SPACE$(20-LEN(s3$))
5540 s4$=" columnwidth: ":s4$=s4$+SPACE$(20-LEN(s4$))
5550 s5$=" left margin: ":s5$=s5$+SPACE$(20-LEN(s5$))
5560 s6$=" centre margin: ":s6$=s6$+SPACE$(20-LEN(s6$))
5570 s7$=" equal columns: ":s7$=s7$+SPACE$(21-LEN(s7$))
5580 s8$=" lines per page: ":s8$=s8$+SPACE$(20-LEN(s8$))
5590 s9$=" right margin: ":s9$=s9$+SPACE$(20-LEN(s9$))
5600 s10$=" header: ":s10$=s10$+SPACE$(21-LEN(s10$))
5610 s11$=" page length: ":s11$=s11$+SPACE$(20-LEN(s11$))
5620 s12$=" font: ":s12$=s12$+SPACE$(20-LEN(s12$))
5630 s13$=" single sheets: ":s13$=s13$+SPACE$(21-LEN(s13$))
5640 s14$=" page numbers: ":s14$=s14$+SPACE$(20-LEN(s14$))
5650 s15$=" front/back pages: ":s15$=s15$+SPACE$(21-LEN(s15$))
5660 warning1$=b$+"input and output file have equal names. Ok ?  Y / N: "
5670 message1$="filename: "
5680 message2$="'"+SCR$+"', '"+PRI$+"' or filename: "
5690 message3$="0 (no new font) or font number <="+STR$(maxfon)+" : "
5700 message4$=b$+"press key for next page "
5710 message5$="print on single sheets ?  Y / N: "
5720 message6$=b$+"feed fresh sheet, then press a key"
5730 message7$="equal columns on last page ?  Y / N: "
5740 message8$="header ?  Y / N: "
5750 message9$="0 (no page numbers) or first page number : "
5760 message10$=b$+"change input ?  Y / N: "
5770 message11$="line width > 255 characters; re-enter data "
5780 message12$="-= no difference ; start with: F= front , B= back page : "
5790 message13$="PLEASE WAIT"
5800 message14$=b$+"rerun program ?  Y / N: "
5810 IF disc THEN RETURN  'else adjust messages
5820 message1$="press <TAB> (= no name) or enter "+message1$
5830 message2$="<TAB>, "+message2$
5840 RETURN
5850 '--------------------------------
5860 '
5870 '-------DEFAULT VALUES-----------
5880 'change these as you like
5890 pencolour=13         'white
5900 papercolour=0        'black
5910 disc=0               'no disc drive
5920 slow=1               'no keyboard look ahead
5930 nc=2                 'number of columns
5940 cw=40                'column width
5950 lm=8                 'left margin
5960 cm=4                 'centre margin
5970 rm=4                 'right margin
5980 header$="A Risk Analysis: Will The Barking Computer Bite ?"
5990 equ$="N"             'not equal height columns
6000 head$="Y"            'header
6010 infile$=""
6020 outfile$="SCREEN"    'output going to screen
6030 pll=66               'page length in lines (for 11" paper)
6040 lpp=60               'print 'lpp' lines per page (lpp <= pll)
6050 pagnum=1             'pagenumbering starts at 1
6060 font=0               'no change of font
6070 frobac$="-"          'no front/back pages
6080 single$="Y"          'single sheets
6090 RETURN
```

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